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Junior FORT DODGE
BIO-CHEMIC REVIEW

JUNE 1934

A. V. M. A. EXHIBIT AT WORLD FAIR

We were happy to learn that the veterinary profession is to be honored with an exhibit at A Century of Progress Exposition in Chicago this summer.

The A. V. M. A. has arranged a comprehensive exhibit in the Hall of Science, showing veterinary practice, field and laboratory research, biological manufacture, and other professional phases.

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D. M. Campbell, Editor A. T. Kinsley, Associate Editor
H. J. Mostyn, R.K.O. Bldg., New York, Eastern Representative

It is estimated that the clean up of bovine tuberculosis in the United States under contemplation by the Department of Agriculture will eliminate approximately 700,000 cows.

* * * *

In the opinion of research workers at the Michigan Experiment Station vaccines may often be used effectively for controlling mastitis in cows. Where tests were made the cows recovered in nearly all cases. In the cows which did not recover a large amount of damage had already been done to the udder before vaccination. "Effectiveness of the vaccine," the report continues, "seems to depend upon the extent of the disease and the response of the individual animal."

* * * *

The extensive experimental work of Mellanby supports the conclusion that perfectly calcified and regularly arranged teeth in dogs can be produced by including in the maternal diet during pregnancy and lactation, and in the diet of the offspring at the time of dental development, substances containing much fat-soluble vitamin, calcium and phosphorus, e.g., milk, egg-yolk, fish and animal fats. Exposure to sunlight or ultra-violet irradiation may supply the vitamin D. Cereals, especially those rich in embryo such as oatmeal, tend to produce badly developed teeth and call for a correspondingly larger supply of calcifying foods for good development.

The average production of 20% of the 25 million cows in the United States is less than 110 pounds of butter fat per year. These five million cows return their owners less than the cost of feed and care, and are therefore, a source of continual loss so long as they stay in the herds.

* * * *

To eliminate overproduction, Danish dairy farmers are rigidly culling their herds. They have already slaughtered 10,000 cattle and have burned their carcasses in order not to add to the meat surplus. It is stated that 50,000 cows will be destroyed this year.

* * * *

The gross farm income from crops and live stock for 1932 was estimated by the Department of Agriculture to be $5,143,226,000. Of this, milk and its products supplied 24.5% and dairy beef and veal an additional 3.9%. Thus the income from dairying was 28.4% of the total farm income. In 1932 cotton supplied 8.4% of the farm income; wheat, 3.4%; corn and hogs, 12.1%, and tobacco, 2.2%. Thus, cotton, wheat, corn and hogs and tobacco were responsible for 26.1% of the farm income as compared with 28.4% from dairying. The producers of octton, wheat, tobacco, hogs and corn have been allotted a total of 756 million dollars in subsidies. The dairy farmers are now clamoring for theirs.

Social Medicine

At a joint meeting of the American Academy of Social and Political Science and the College of Physicians of Philadelphia, February 7th, the principal topic of discussion was Socialized Medicine. The organized medical profession has strenuously opposed either Socialized Medicine or State Medicine on the ground that it is bad for the patient and will limit, if not stop, the rapid progress that has been made in medical science during the past half century. However, the enemies of organized medicine are gaining strength rapidly and it will require more effective opposition than has yet been developed by the medical profession to prevent a trial of some form of state or socialized medicine.

Group hospitalization insurance first started as an experiment at Baylor University, Dallas, Texas, is gaining in favor rapidly. More than 100 hospitals are at present taking part in these plans in about 40 different cities; 30 cities in 21 states have started group hospitalization within the last 12 months.

The plan has the endorsement of the American Hospital Association and a number of medical societies. Essentially the plan is based upon the fact developed from statistics, that about one person in twelve will require hospitalization each year; or, on the average, a person requires hospitalization about once in twelve years. The price of such hospitalization ordinarily varies from $100 to $300. Under the group hospitalization plan, each member of the group pays an annual hospital fee, varying depending upon the plan, from $5.00 to $12.00. This entitles him to free hospitalization ordinarily for not more than about three weeks in any one year.

The hospitals favor it because it assures them a steady income. The advantage to members of the group is that it provides hospitalization at a much lower price than otherwise, and enables them to pay for hospitalization while employed.

Why Cows Are Culled

The Iowa December report of cow testing activity in that state shows 288 dairy cows were culled from C. T. A. members' herds during the month. The reasons are interesting:

		%
Low producers	128	44
Udder trouble	31	11
Sterility	37	13
Abortion	35	12
Death	23	8
Old age	5	2
T. B. reactor	20	7
Accident	2	1
Other reasons	7	2

Firsts in Dairy Products

The first ice cream advertisement appeared, in the *New York Gazette*, 1777.

Dolly Madison served ice cream at a White House party in 1811.

The first delivery of milk into New York City by train occurred in 1841.

The first cheese factory in America was opened in 1841.

The wholesale production of ice cream was commenced in Baltimore in 1851.

The first commercial process for drying milk was invented in 1855.

The ice cream soda was introduced at the Centennial Exposition, Philadelphia, in 1876.

The manufacture of malted milk was begun in 1883.

The present type of milk bottle was invented in 1889.

Pennsylvania State College established the first course in ice cream making, in 1892.

The ice cream cone was introduced at the World's Fair, St. Louis, in 1904.

The announcement that pasteurization killed practically all pathogenic organisms was made in 1907.

Methods were introduced for increasing the vitamine D content in milk, in 1932.

Effective sanitation and preventive medicine is of relatively recent origin. By a study of records, it has been found that in the Mexican war 2,731 men died from wounds, while 15,064 died of disease.

In four years of the Civil war 110,000 Union men died of wounds; whereas deaths by disease numbered 239,874.

During the Spanish-American war and the Philippine insurrection 901 died of wounds while 5,509 died from disease. This shows that disease was far more fatal than fighting.

The conditions were exactly reversed in the late world struggle—49,706 Americans died of wounds, but disease killed only 23,451 even though a terrible flu epidemic swept the entire world. Better sanitation caused the reduction of fatalities from disease.

Discoveries

Anton Leeuwenhoek (1632-1723) a Holland merchant, was the first to see bacteria. He took up lens grinding as a hobby and followed it for 50 years, making better microscopes than anyone had made before him.

Lazzaro Spallanzani (1729-99) an Italian priest, was the first to explode the theory of spontaneous generation by proving that bacteria and ferments do not develop spontaneously in suitable media, but come from others of their kind. He was the first to isolate a single bacterium and watch it divide to make two and four, etc.

Louis Pasteur (1822-95) a French chemist, was the first to vision microbes as a possible menace to higher animals; to discover the cause of fermentation, and to make an artificial vaccine (chicken cholera, anthrax, rabies); Jenner's smallpox vaccine being regarded as a natural product.

Robert Koch (1843-1910) a German physician, was the first to prove that bacteria cause disease (anthrax) and was the discoverer of the tubercle bacillus, the bacillus of asiatic cholera, of tuberculin, the spore form of bacteria (anthrax) and was the originator of solid media on which to cultivate bacteria.

Frederick Loeffler (1852-1915) a German physician and army surgeon, discovered the *Bacillus diphtheriae;* Emile Roux (1853-1933) a French physician, was the first to discover a bacterial toxin (that of diphtheria), and contributed equally with Emil Behring (1854-1917) a German physician, to the discovery of diphtheria antitoxin.

Elie Metchnikoff (1845-1916) a Russian Jew naturalist, was the discoverer of phagocytosis.

Fred L. Kilborne (1858-....), an American veterinarian, Theobald Smith (1859-....), an American physician, and Cooper Curtice (1856-....), an American veterinarian, were the first to discover that disease (Texas fever) may be insect (tick) borne.

David Bruce (1855-1931), a Scot physician and medical officer in the British army, was the first to prove a trypansome the cause of disease of animals (nagana) and of man (African sleeping sickness), and that both diseases are transmitted by tsetse flies. He also discovered the Brucella organism.

Alphonse Laveran (1845-1922), a French physician and army surgeon, discovered the malaria parasite; Ronald Ross (1857-1932), (born in India, son of an English general) a medical officer in the British army, discovered that the parasites of bird malaria pass one stage of their life cycle in mosquitos, and Battista Grassi, an Italian physician and zoologist, discovered that the anapholes mosquito transmits malaria from one person to another by its bite.

Carlos Finaly, a Cuban physician, was the first to proclaim that mosquitos carried yellow fever. Walter Reed, James Carroll and Jesse Lazeare, American physicians and medical officers in the U. S. Army, discovered the rôle of the *Aedes Egypti* in yellow fever and made the conquest of that disease possible.

Paul Erlich (1854-1915), a German physician, was the discoverer that arsenic (606) injected intravenously will kill all syphilis organisms in an infected person (in some stages of the disease) and lead to immediate recovery.

An Important Field for Veterinary Service

Never before has there been so much public interest in wild life conservation and wild life restoration as there is at the present time. The Congress has recently passed three important bills, fostered by the American Game Association, for wild life restoration.

One of these bills, the Walcott-Kleberg Duck Stamp bill, it is estimated will produce a revenue of approximately a million dollars a year, to be used in the rehabilitation of wild fowl. Not less than 90% of the sum raised by the purchase of a $1.00 duck stamp, to be affixed to each license to hunt wild fowl, shall be used for the purchase and maintenance of breeding, feeding and rest refuges for game birds.

A second bill, the Robinson Refuge bill, authorizes the Federal government to establish fish and game sanctuaries in the national forests with the consent of the states.

A third measure, the Coordination bill, is designed to coordinate the activities of the various departments of the Federal government dealing with phases related to the welfare of wild life. More than 18 million licensed hunters and fishermen in this country and several millions more in Canada will be benefited by these measures.

In addition to this, Secretary Ickes has made available large sums from the PWA funds for wild life restoration. The legislatures of Oklahoma, New Jersey, Iowa, Michigan and several other state governments have been equally active in promoting the breeding and protection of game animals, fowl and fish within their confines.

In the bills so far passed and the commissions organized to carry out their provisions, not much has been said about disease control, but that may be expected to come later, since contrary to what was formerly supposed, it is now known that wild animals and wild fowl suffer from infectious diseases and parasitisms much as do domestic animals and birds.

The control of destructive contagious diseases and parasitisms among game animals, wild fowl and fish will require specialized veterinary service, for which ambitious members of the profession

"THE WOULD-BE HANDY MAN ABOUT THE FARM"

might well take steps to prepare themselves.

Unfortunately, this branch of veterinary service has received far too little attention in the veterinary colleges of the past; but it is stated that at least one of them (Iowa) will include an elective course in the diseases of game animals and game birds next year.

Book Review

America Self-Contained, by Samuel Crowther. Octave of 340 pages. Published by Doubleday, Doran & Company, Garden City, New York. Cloth, $2.00.

This work is endorsed and its distribution supported by The Chemical Foundation, 654 Madison Ave., New York, otherwise the price would probably be higher.

The chemical industry is the principal laboratory and post-graduate school of American scientific progress, and American scientific progress is the index and physician of our national peace or defense, of our national agriculture and industries, and, above all, of our national health. Its endorsement will go a long way to give this work an authoritative standing with the scientific world.

In these days of international enmity and bitterness, it is the fortunate nation which cen stand alone.

For the first time, says Samuel Crowther, America is practically self-contained and can and should depend upon her own resources. There is scarcely one important commodity we need import. We can even produce rubber synthetically. We have the inventors, the research chemists, the machines, the raw materials that will enable us to compete with all nations. We have the highest purchasing power of any people and by reason of our high standards of living, we are the greatest consumers of American goods.

With planned industry, now possible under the Recovery Act, we can be self-contained. Let us, says Mr. Crowther, be the controllers of our own destinies.

This book gives one a glimpse of how well the American chemical industry has lived its trust. In living its trust it has been aided by the Congress, by the colleges and schools, and by the support of the American people.

It is a work you will want to read—must read to be informed on present political and social problems, domestic and international.

The A. M. A.

The American Medical Association was organized in 1847; the Judicial Council of the Association was organized in 1873; the Journal of the Association was established in 1883; the Scientific Exhibit was established in 1899; The Council on Medical Education was established in 1904; the Council on Pharmacy and Chemistry in 1905; the Bureau of Investigation in 1906; the annual publication of "New and Nonofficial Remedies" was begun in 1908; the Council on Health and Public Instruction and the American Medical Association Library were established in 1910; the Council on Scientific Assembly in 1915; the Bureau of Legal Medicine in 1922; the Council on Physical Therapy in 1925; the Central Scientific Exhibit and the Committee on Foods in 1929; the Bureau of Exhibits in 1930 and the Bureau of Medical Economics was established in 1931.

The Association publishes the following magazines: *The Journal of the American Medical Association* (Est. 1883); the *Archives of Internal Medicine* (Est. 1909); *The American Journal of Diseases of Children* (Est. 1911); the *Archives of Neurology and Psychiatry* (1919); the *Archives of Surgery* (1920); the *Archives of Dermatology* and *Syphilology* (1920); *Hygeia* (1923); the *Archives of Otolaryngology* (1925); the *Archives of Pathology* (1926) and the *Archives of Ophthalmology* (1929). It also publishes the Medical Directory and the Index Medicus; maintains a daily radio program, has a great number of booklets and pamphlets for the information of laymen on health and medical matters, and performs a great number of services for physicians and for the medical profession in states and smaller areas and as a whole.

Fouadin in the Treatment of Infestations with the Dog Heart Worm, *Dirofilaria immitis*[*]

By WILLARD H. WRIGHT and PAUL C. UNDERWOOD
Zoological Division, Bureau of Animal Industry, U. S. Department of Agriculture

Introduction

SINCE the rapid spread, during the past few years, of the dog heart worm from enzootic areas in the southern states to states along the Atlantic seaboard as far north as Pennsylvania and New York, the Zoological Division has received numerous requests for information concerning methods of therapy which might be of value in infestations with this parasite. At the time these investigations were inaugurated over three years ago, there was no readily available drug which was known to be of any particular value in this condition and at the same time sufficiently safe for general use. The urgent demand on the part of veterinarians, dog breeders and sportsmen for information on the subject led the Zoological Division to undertake the studies in question.

Any treatment for heart-worm infestation may be aimed at one or more objectives. It may be directed toward the destruction of the microfilariae in the blood stream and the sterilization of adult female worms, thus rendering the treated animal incapable of acting further as a reservoir from which infection may spread; or, it may be aimed at the destruction of the adult worms in the heart or other locations in the body. This last objective involves some rather delicate considerations. The rapid destruction of any great number of adult parasites in the right heart would probably result in the dead worms being swept down the pulmonary artery where they might cause embolism, or result in mechanical pneumonia with consequent danger to the life of the host. It would not seem advisable or desirable, therefore, to make use of any drug in a manner which might result in a rapid destruction of the adult worms. These considerations have been kept in mind.

Review of Literature

Itagaki and Makino[2] treated 17 dogs infested with *Dirofilaria immitis* with sodium antimony tartrate in doses of 0.001 to 0.085 gram per kilogram of body weight administered intravenously at varying intervals over a period of 5 to 30 days. The treatment caused the disappearance of the microfilariae from the peripheral circulation but on necropsy of the animals living adult worms were found in the heart in each instance. Some of the dogs showed marked reactions to the treatment. These workers observed a possible sterilizing effect of the drug on female worms, as female worms recovered from one dog killed 8½ months after the end of the treatment had no larvae in the uteri; the possibility that the worms were sterile because of senility is not excluded.

Zibordi[16] tried intravenous injections of atoxyl and formalin without observing any reduction in the number of microfilariae.

MacCallum[7] reported *in vitro* tests of a number of drugs on the microfilariae of *Dirofilaria immitis;* he found that most drugs were ineffective in a dilution compatible with their administration by intravenous injection. Quinine in dilutions of 1:5000 and emetin in dilutions of 1:7000 were lethal for the parasites. On intravenous injection in these dilutions, quinine killed the dogs before it killed the worms, but emetin (efficacy not ascertained) was tolerated.

Wada[15] treated seven dogs with neostibnal in an average dose of 0.011 gram per kilogram, administered subcutaneously for 12 to 36 injections. Microfilariae disappeared from the peripheral circulation of all dogs treated. Living adult worms were found on

[*]These investigations were financed in part through a fund provided by the Sportsmen's Gun-Dog Club, Philadelphia, Pa.

necropsy in four of the seven dogs; in two dogs no worms were found; while one dog escaped before the conclusion of the experiment. In one of the animals in which living worms were found, a dead adult worm also was found in the left lung. We were unsuccessful in an effort to obtain a supply of neostibnal for experimental use.

Panda[8] tested a number of drugs on dogs infested with *Dirofilaria acutiuscula* (Syn., *D. repens*), the adults of which occur in the subcutaneous tissues. Panda found the following ineffective in destroying either the microfilariae or the adult worms: Atoxyl, Bayer 205, formalin, mercury perchloride, Lugol's solution, neosalvarsan, rivanol and serum therapy. A diminution in the number of microfilariae was obtained in some cases with the use of sodium antimony tartrate but the drug had no effect on adult worms.

Hayes[1] has reported good results in treating heart-worm infestations with a preparation said to contain a double salt of antimony but the chemical composition of which has not been disclosed.

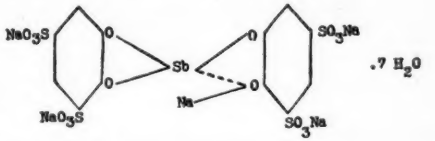
Preliminary Experiments

In the beginning, experiments were carried out involving the intravenous injection of carbon tetrachloride or solutions of neutroflavine. However, these drugs failed to have any effect in reducing the number of microfilariae in the peripheral circulation.

Because of the successful application of Fouadin in the treatment of schistosomiasis in man in Egypt by Khalil and his coworkers,[3,4,5] the writers were led to try this drug in cases of heart-worm infestation. However, before the experiments were actually under way, it was learned through correspondence that the drug mentioned by Philipp[9] as giving good results in the treatment of heart-worm disease was Fouadin.

Popescu[10] also was apparently one of the first to use Fouadin as a treatment for heartworm infestation in dogs. In a paper devoted to tests with neosalvarsan, stovarsol and neostibosan, Popescu mentions the use of Fouadin for this purpose. His first paper is not available to us but apparently it appeared at about the same time as did our preliminary notes on the subject.[13,14] Popescu[11,12] subsequently has published in more detail concerning his experiments, although he does not refer in his papers to the effect of Fouadin on the adult worms.

Fouadin* is a proprietary preparation consisting of a 6.7% solution of sodium-antimony III bis-pyrocatechin disulphonate of sodium, having a pH of 7, and containing 13.5% of trivalent antimony. It has the following graphic formula:



This drug was selected not only because of its proved parasiticidal power in schistosomiasis, but also because of the ease of its administration, and the fact that pharmacological tests had indicated that it was safer than are most other compounds of antimony because of the complex binding of the antimony valences with other constituents of the molecule. Most antimony compounds must be injected intravenously and even then careful technic is required to prevent leakage of the solution into, and destruction of, the perivascular tissues. Fouadin can be injected intramuscularly without appreciable unfavorable local reactions, thus simplifying to a considerable extent the technic of administration, particularly in small dogs.

For the treatment of schistosomiasis, Khalil recommended for a person weighing 60 kilograms an initial dose of 1.5cc of Fouadin, a dose of 3.5cc on the 2nd day, and a dose of 5cc on the 3rd day and every other day up to, and including the 15th day, for a total amount of 40cc.

In our preliminary tests, the dose rate used by Khalil for man was adopted in the treatment of two dogs. For two other dogs a slightly decreased dose rate was employed. These latter animals were given an initial dose of 1cc each and the dose was gradually increased until a maximum of 3.5cc was being given every other day after the 9th

*Fouadin is marketed in the United States by the Winthrop Chemical Co., 170 Varick St., New York, N. Y.

Fig. 1.—Dog 1972 still negative to examinations for microfilariae 29 months after treatment with Fouadin.

day. The intramuscular administration of the drug at these dose rates resulted in extremely severe systemic reactions, culminating in the death of three of the four animals, six to eight days after the beginning of the treatment. At the time of death, however, microfilariae had either disappeared from the peripheral circulation or their numbers had become greatly diminished. In the only animal of this group surviving this method of treatment, it was necessary to discontinue the injections after the 11th day owing to the severity of the reaction resulting from doses of Fouadin totaling 17cc. Blood examinations on this dog were negative for microfilariae the 10th day after treatment was started. The dog, 1972 (Fig. 1), made an uneventful recovery and at the present time, 29 months after treatment, has remained consistently negative to examinations for microfilariae in the peripheral circulation.

Experiments with Revised Dosage of Fouadin

Intramuscular administration.—Injections were made in the prescapular muscles or the gluteal muscles, injections being alternated between muscles on either side of the body. The skin over the area of injection was shaved and properly disinfected, and aseptic precautions were taken at all times. Larval counts were made daily prior to treatment, during treatment, and following treatment. For this purpose, 0.01cc of blood was drawn from the posterior auricular vein into a calibrated pipette containing an equal amount of sodium citrate solution to prevent coagulation. The mixture was placed on a glass slide and the number of microfilariae in the preparation counted.

Many different dose rates of the drug were tried with a view to arriving at a satisfactory dose for dogs of different weights. However, there is a marked difference in the tolerance of individual dogs for the drug, and in some of the cases it was necessary to suspend treatment for varying periods of time on account of the appearance of unfavorable reactions. This observed difference in the susceptibility of different dogs to the drug is accounted for by several factors. We have noted that in most cases dogs reacting to moderate doses of Fouadin have shown on post-mortem examination organic heart lesions usually involving a thickening of the right auriculo-ventricular valve with or without the presence of verrucous growths. In many cases of heavy heart-worm infestation or in cases of moderate infestation of apparent long standing, the cumulative injury to the circulatory system has resulted also in pronounced hyperplasia in the walls of blood vessels in the liver and kidneys, with cirrhosis and chronic interstitial nephritis. It is obvious that dogs suffering from such defects in vital organs are not in good condition to withstand added insult to these organs. Such conditions, in cases where they can be diagnosed, should be an indication for caution in the administration of any treatment for heart-worm infestation.

Table 1 presents the protocols of experiments on representative dogs treated with intramuscular injections of Fouadin at varying dose rates. In these cases treatment was stopped as soon as the peripheral circulation became negative to examinations for microfilariae. Gaps in the course of treatment in several dogs represented in the table indicate that there ensued reactions of such a nature that it was necessary to suspend treatment for the time indicated or that microfilariae returned in small numbers in the peripheral circulation after blood examinations were negative to microfilariae. In these latter cases, additional doses of the drug were

Table 1.—Protocols of representative dogs treated with intramuscular injections of Fouadin.

Table 1.—Protocols of representative dogs treated with intramuscular injections of Fouadin.

DOG	DAY OF TREATMENT																									WEIGHT		Reaction to Treatment	No. of days between end of treatment and death of animal	NECROPSY FINDINGS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Before Treatment	At End of Treatment			
No.	DOSE IN CUBIC CENTIMETERS																										*Kgm.*	*Kgm.*			
313	0.5	0.5	0.5	0.5	0.5	0.5		1.0	1.0	1.0	1.0	1.0	1.0		2.0	2.0	2.0	3.0	3.0	3.0		3.0	3.0				23.6	23.6	Tempt. 103° F. on 20th day	3 (killed)	18 *Dirofilaria:* all living.
314	0.5	0.5	0.5	0.5	0.5	0.5		1.0	1.0	1.0	1.0	1.0	1.0		2.0	2.0	2.0	3.0	3.0	3.0		3.0	3.0	3.0			17.5	17.5	None	134 (killed)	All *Dirofilaria* dead and degenerated.
349	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5		1.0	1.0	1.0	2.0	2.0	2.0		2.0	2.0	2.0			22.7	22.7	Rise in Tempt. up to 104° F. between 23d and 26th days	5 (died from organic heart disease and effects of treatment.)	6 *Dirofilaria:* all living.
355(1)	1.0	1.0	1.0	1.0	1.0	1.0		2.5								2.5		2.5	2.5			2.5	2.5				17.0	14.1	Rapid pulse & blood in feces on 8th day	2 (died from pyelonephritis)	5 dead; 2 living *Dirofilaria.*
356	1.0	1.0	1.0	1.0	1.0	1.0		2.0	2.0	2.0	2.0	2.0	2.0						2.5	2.5		2.5				2.5	17.3	18.6	Tempt. 103° F. on 13th day	105 (killed)	2 dead degenerated *Dirofilaria:* 2 live *Dirofilaria.*
415	2.0	2.0	2.0		2.0	2.0		2.5	2.5	2.5	2.5	2.5	2.5		2.5												26.6	30.0	None	39 (killed)	18 live *Dirofilaria:* numerous dead and encapsulated.
530	2.0	2.0	2.0	2.0	2.0	2.0		3.0	3.0	3.0	3.0	3.0															12.5	13.0	Tempt. 103° F. on 13th day	32 (killed)	No *Dirofilaria* present.
537	1.5	1.5	1.5	1.5	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0														19.0	?	None	Not killed	Discharged to owner.
544	2.0	2.0	2.0	2.0	2.0			2.0	2.0	2.0	2.0	2.0															24.9	24.6	None	Not killed	Discharged to owner.
A(2)	0.5	0.5	0.5	0.5	0.5	0.5			1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0		2.0	2.0	2.0	2.0	2.0	19.0	?	Tempt. of 103.5° F. on 23rd day	Not killed	Discharged to owner.
D	1.0	1.0	1.0	1.0	1.0	1.0		2.5	2.5	2.5		2.5	2.5		2.5												22.0	21.4	None	Not killed	Discharged to owner.

Sunday—No Treatment

(1) Received an additional dose of 2.0 cc. on each of 44th to 47th days, inclusive.
(2) Also received 2.0 cc. on 27th day.

Table 2.—Protocols of representative dogs treated with intravenous injections of Fouadin.

DOG	DAY OF TREATMENT																				WEIGHT		Reaction to Treatment	No. of days between end of treatment and death of animal	NECROPSY FINDINGS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Before Treatment	At End of Treatment			
No.	DOSE IN CUBIC CENTIMETERS																				*Kgm.*	*Kgm.*			
524	1.0		2.5		2.5		2.5	2.5	5.0	5.0		5.0									21.2	20.5	None	65 (killed)	No *Dirofilaria* found.
525	(1) 5.0	5.0	5.0				5.0														22.7	?	None	37 (killed)	1 live female near death. Numerous dead worms encapsulated in lungs.
528	1.0		2.0		2.5		2.5	2.5	5.0	5.0		5.0									16.8	15.9	None	66 (killed)	5 living *Dirofilaria:* 1 dead *Dirofilaria.*
529	3.5	3.5	3.5	3.5	3.5																11.8	12.3	Tempt. 103° F. on 3d day. Severe reaction.	39 (killed)	No worms recovered.
533	(1) 3.0																				5.9	?	Severe reaction. Died on 7th day organic heart disease	7 (died)	9 live *Dirofilaria.*
554	1.0		2.5		2.5		2.5	2.5	5.0	3.0		3.0									12.0	11.6	None	14 (died)	31 live *Dirofilaria.*
555	1.0		2.5		2.5		2.5	2.5	5.0	3.0		3.0									12.3	11.4	None	51 (killed)	15 dead *Dirofilaria.*
557(2)	1.0		2.5		2.5		2.5	2.5	5.0			3.5							3.5		21.4	19.6	Tempt. of 103.4° F. on 22nd day. Lameness in posterior limbs. Orchitis.	38 (killed)	34 live *Dirofilaria.* Undetermined number of dead worms. Some of live worms degenerated internally and near death.
558(3)	(1) 3.0	5.0	5.0																		37.7	39.6	Tempt. 103.2° F. on 28th day.	38 (killed)	21 live *Dirofilaria.* Undetermined number of dead worms.

(1) Received equal parts of Fouadin and calcium gluconate 10% sol. (2) Received 3.5 cc. on each of 21st, 24th, 25th and 26th days. (3) Received 5 cc. on each of 28th, 31st, 33rd, 36th, 38th, 45th and 47th days.

given until the peripheral circulation remained permanently negative to examinations for larvae.

Dog 355 showed on the 8th day such a marked reaction to the treatment that injections were suspended until the 16th day when they were resumed cautiously. In spite of the precautions taken in this case, the dog died two days after the completion of the treatment. Necropsy revealed chronic lesions of a serious nature. The heart was hypertrophied and the liver markedly cirrhotic; the kidneys showed marked chronic interstitial nephritis and an extensive pyelonephritis; there was a chronic cystitis and the bladder contained a considerable amount of pus. An inflammation of a chronic type was present throughout the gastrointestinal tract. Obviously, this animal was a poor risk.

Dog 356 became negative to examinations for microfilariae on the 15th day and treatment was discontinued. However, on the 19th day one larva was found in the blood sample and additional injections were made on the 19th, 20th, 22nd and 26th days, after which the blood remained negative.

Dog 349 was apparently in good condition at the time of treatment but died five days after the last injection of Fouadin. On postmortem examination the heart was found to be enlarged; there was a marked cirrhosis of the liver; and there was noted in the right auricle immediately above the tricuspid valve a calcareous growth approximately 1cm. in diameter which interfered with the valve.

Dog A was accepted from its owner as an experimental animal, to be treated at the owner's risk and returned if cured. The animal was in very poor condition and was considered a poor risk for treatment. Accordingly the treatment was administered with considerable caution and minimum doses used. The animal showed a very high microfilaria count prior to treatment. There was arrhythmia of the heart, marked expiratory dyspnea, and a deep bronchial cough which was manifested in paroxysms lasting for several minutes at a time. A subcutaneous tumor of firm consistency and about 6cm. in diameter was located on the left side of the trachea at the thoracic inlet. Other than the rise in temperature to 103.5° F. on the 23rd day of treatment, the animal showed no reaction to the course of injections. The subcutaneous tumor disappeared following treatment. There was marked improvement in the respiratory condition and the bronchial cough disappeared. The animal was returned to the owner, apparently in a good condition.

It will be noted that the majority of dogs represented in Table 1 maintained their weight during the course of the treatment. Marked loss of weight occurred in only one animal (355); as pointed out, this dog was in a serious condition prior to treatment.

From the experimental data at our disposal, we would suggest the dose rates given in Table 3 as being suitable for intramuscular use in dogs of various weights, assuming that the animals are in good or fair physical condition and are not suffering from organic heart disease, from marked cirrhosis of the liver, or from marked nephritis. These conditions, and possibly others yet unknown to us, are contraindications for treatment with Fouadin; or, if treatment is attempted in animals suffering from such conditions, lower dose rates should be used and the patient should be held under close observation and injections discontinued or suspended temporarily if reactions ensue. It has been our practice in using Fouadin intramuscularly to omit treatment every 7th day and the dose rates in Table 3 are predicated on that basis.

Intravenous Administration. — Alternate injections were made in the right and left saphenous veins. Slight local reactions occurred in some cases, particularly in small dogs where the vein was difficult to locate and where some of the solution penetrated the perivascular tissues. These reactions, which consisted mostly in a slight edema, disappeared promptly.

Table 2 presents the protocols of representative dogs treated with Fouadin intravenously. As in the case of intramuscular injections, various dose rates were employed in an effort to arrive at suitable dose rates for dogs of different weight. As later experience showed, the dose rates used in several cases were too high and resulted in marked reactions culminating in some cases in death.

Table 3.—Suggested dose rate in cubic centimeters for intramuscular injection of Fouadin in dogs in good physical condition and not suffering from organic heart disease, or liver or kidney affections

Body weight of dog	*Daily dose for first 6 days*	*Daily dose for second 6 days*	*Daily dose after second 6 days*
Under 10 kilograms (22 pounds)	0.5	1.0	1.0
10 to 15 kilograms (22 to 33 pounds)	1.0	1.5	1.5
15 to 20 kilograms (33 to 44 pounds)	1.0	1.5	2.0
20 to 25 kilograms (44 to 55 pounds)	1.5	2.0	2.0
Over 25 kilograms (55 pounds)	2.0	2.5	2.5

Table 4.—Suggested dose rate in cubic centimeters for intravenous injection of Fouadin for dogs in good physical condition and not suffering from organic heart disease, or liver or kidney affections

Body weight of dog	*1st Day*	*3rd Day*	*5th Day*	*7th Day*	*8th Day*	*9th Day*	*10th Day*	*12th Day*
Under 10 kilograms (22 pounds)	0.5	0.5	0.5	1.0	1.0	1.5	1.5	1.5
10 to 15 kilograms (22 to 33 pounds)	1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.0
15 to 20 kilograms (33 to 44 pounds)	1.5	1.5	1.5	2.0	2.0	2.5	2.5	2.5
20 to 25 kilograms (44 to 55 pounds)	2.0	2.0	2.0	2.5	2.5	3.5	3.5	3.5
Over 25 kilograms (55 pounds)	2.5	2.5	2.5	3.5	3.5	5.0	5.0	5.0

Dog 529 was in poor condition at the beginning of treatment. The temperature rose to 103° F. on the 3rd day and there was a very rapid pulse. The temperature dropped on the following day but the dog continued to show marked prostration. On the 7th day of treatment, the animal was given 20cc of a 10% solution of calcium gluconate intravenously, after which it showed some improvement. An injection of 75cc of physiologic saline solution was given intravenously on the 10th day and the animal continued to improve rapidly. As later experience indicated, the dose rate in this case was excessive.

Dog 533 was an aged animal suffering from heart disease as indicated by stethoscopic examination prior to treatment. Post-mortem examination indicated that the right auriculo-ventricular valve was considerably thickened and that there was a chronic diffuse nephritis, both kidneys being involved. The initial dose was entirely too large considering the age and weight of the animal and the existing heart and kidney lesions.

Dog 554 showed no appreciable reaction during the course of treatment. It died suddenly on the 14th day after the beginning of treatment. Post-mortem examination showed verrucous patches on the cusps of the right auriculo-ventricular valve. The right kidney was absent, the left hypertrophied. The dose administered to this animal was apparently excessive in view of its weight, the condition of the heart, and the absence of the right kidney which threw the burden of eliminating the drug upon the already overburdened left kidney.

Especial attention is called to dog 557. On the 10th day of treatment this animal showed a marked swelling of the scrotum which was hot and painful to the touch, with evident orchitis present. The dog was stiff and refused to walk when allowed out of the cage. The orchitis subsided under local treatment. This complication was observed in another case not represented in Tables 1 and 2 and apparently is not an infrequent sequela of treatment with Fouadin as Popescu[12] has encountered it also.

Table 4 gives suggested dose rates for intravenous administration of Fouadin to dogs of different body weight. The doses are designed for dogs in good or fair physical condition. Where clinical examination indicates the presence of heart lesions or where there is reason to believe that animals may be suffering from affections of the liver or kidneys, either treatment should not be attempted or the dose should be reduced and the patient kept under careful observation during the course of the treatment. At the first appearance of reactions, the injections should be suspended or discontinued.

The intravenous administration of Fouadin is of advantage in shortening considerably the period of treatment. It would appear to be indicated especially for large dogs in which the saphenous vein is prominent and in which the injection is easy to make, and in dogs in good condition which might

be expected to tolerate rapid absorption of the antimony contained in the compound. For animals in a weakened condition and for those suffering from heart, liver or kidney affections, intramuscular injection would seem to be the preferred method for the reason that the drug is less rapidly absorbed, the toxic effect is not so rapidly cumulative, and the administration can be better controlled, with less likelihood of causing serious reactions.

Results of Treatment

As noted in Tables 1 and 2, animals were killed at various periods of time following the completion of the treatment. During the period in which they were held, numerous examinations were made of the blood for microfilariae. In addition to examining blood drawn from the posterior auricular vein, a quantity of blood was obtained either from the saphenous vein or directly from the heart, centrifuged and examined for microfilariae. With the exception of one animal, all dogs remained permanently negative to examinations for microfilariae. In those animals which died or which were killed within a few days after the completion of the treatment, live adult worms were found in the heart and other locations. In these cases, larvae within the uteri of female worms failed to respond to stimuli and were apparently dead. In dogs killed on the 37th day after the termination of the treatment or later, dead worms were found. The uteri of living female worms recovered from such dogs contained no embryos. The percentage killed of the total number of adult worms originally present varied. It is apparent from our tests that the lethal effect of Fouadin on adult worms is cumulative and is exercised over a considerable period of time. In many of our cases, the drug was still exerting an effect on the adult worms in the heart and pulmonary artery, as many worms not actually dead showed degenerative changes and were apparently approaching death. The apparent cumulative action of Fouadin appears to be of a distinct advantage in the treatment of heart-worm infestation. Such an effect exercised over a considerable period of time leads to a rather slow destruction of adult worms and permits the body defenses adequately to take care of the great amount of foreign protein material.

Dogs treated with Foudin have usually shown a good clinical improvement following treatment. The working capacity of field dogs returned to owners has been increased for the most part, and the dogs apparently do not tire so easily as before treatment. Dogs kept in our own laboratory for varying periods of time following treatment have usually improved in condition and have added weight on a ration not particularly nutritious.

As stated above, with one exception dogs treated with Fouadin have remained permanently negative to examinations for microfilariae. The exception was a valuable Pointer submitted for experimental treatment by a private owner. During the first course of treatment the animal received a total of 48cc of Fouadin intramuscularly. During the period of treatment, the blood became negative several times but microfilariae would later appear in small numbers. The dog was finally returned to the owner after becoming negative to several examinations. However, several months later we again had an opportunity of examining the blood and found a few microfilariae in centrifuged samples. A second course of treatment was instituted during which the dog received a total dose of 46cc of Fouadin intramuscularly. Even after this treatment, the animal showed an occasional microfilaria in centrifuged blood samples. It is our opinion that the adult female worm or worms in this animal probably were located in subcutaneous tissues where they may be relatively inaccessible to the action of the drug, since the heart worm is sometimes found in a subcutaneous location and also in other locations outside the heart and pulmonary artery.

The Effect of Fouadin on Pregnant Bitches

Dog 558 (Table 2) gave birth to 12 pups on the 18th day after the beginning

of treatment. The animal showed no appreciable reaction to the first three doses and whelped normally. The pups appeared to be normal but nine of them died during the first 24 hours. The bitch whelped on Sunday when no member of the staff was on duty; possibly the pups might have been saved if they could have been assisted to nurse. Two more of the pups died during the next two days. The litter showed no apparent indication of congenital weakness although it is difficult to estimate the effect of the treatment on the pups. It seems probable, however, as a general measure of safety that bitches should not be treated with Fouadin during late pregnancy.

The Blood Calcium Level During Fouadin Treatment

Blood chemistry studies on two dogs not infested with *Dirofilaria* indicated that following the injection of 20cc and 25cc of Fouadin over periods of four and five days, respectively, there was a marked drop in the blood calcium level, although there was no indication of a bilirubinemia. However, similar studies on an infested dog treated with Fouadin in a dose of 5cc on each of two consecutive days indicated that there was no reduction in the blood calcium. Treatment was not continued in this animal as the blood became negative to examinations for microfilariae after the second dose and so remained. It seems probable that there may be a lowering of the blood calcium level during the later stages of treatment with Fouadin. In the event that symptoms of marked depression and tetany appear, the intravenous administration of calcium gluconate is indicated.

Tissue Reaction to Dead Dirofilaria

When adult *Dirofilaria* located in the right ventricle are killed by the drug, they are swept into the pulmonary artery and are carried usually to the terminal branches of that artery. In dogs killed 37 days after the end of treatment or later, the dead worms have been found in the small terminal branches of the pulmonary artery. These dead worms are most numerous in the diaphragmatic lobes of the right and left lungs, though some are distributed in the vessels of the other lobes. The remnants of the dead worms are usually adherent to the walls of the vessel as a result of fibrin formation. As a result of tissue reaction, the foreign material is forced eventually into the parenchyma of the lung where encapsulation and

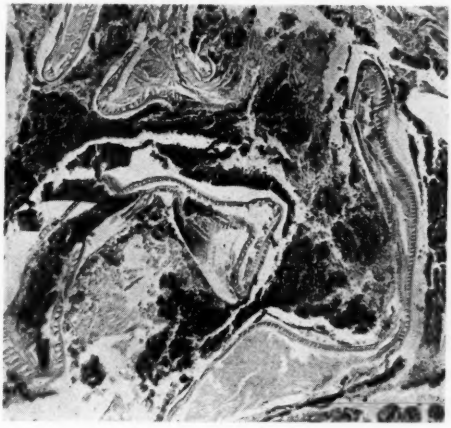


Fig. 2.—Dead adult *Dirofilaria immitis* in bronchiole of Dog 415 treated with Fouadin. X 35.

absorption take place. Histological study of many of these lesions shows the following general picture (Figs. 2, 3 and 4).

The nematode cuticle is virtually the only portion still intact by the time the remnants of the worm reach the parenchyma of the lung. Within the cuticle there is usually a small amount of cellular debris, the remains of the digestive, reproductive and muscular systems of the nematode. Polymorphonuclear neutrophiles, large mononuclear leucocytes and a few lymphocytes and eosinophiles are seen penetrating between the interstices of the cuticle or are found within the cuticle phagocytizing the remaining cellular debris. Surrounding the nematode cuticle, but not immediately in contact with it, is a layer of peculiar hyaline-like material without organization, in which appear many small lymphocytes. On the outside of the hyaline-like material, there is an extensive infiltration of large and small lymphocytes in which appear some fibroblasts. Surround-

ing the layer of round-cell infiltration is a definite connective tissue capsule which walls off the dead material from the functional tissue of the lung. If the encapsulated material is near the surface of the lung, the lesion appears grossly as a raised, circumscribed, dark purplish area. Except in very heavy infestations, it is apparent that only a relatively small proportion of the lung tissue is occupied by the dead and disintegrating worms and there appears to be little

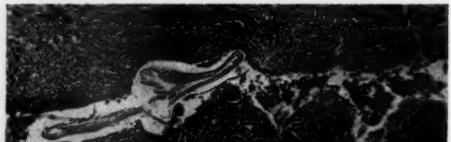


Fig. 3.—Adult *Dirofilaria immitis* encapsulated in lung following treatment with Fouadin. X 35.

interference with normal function. The chief danger from the presence of dead worms seems to lie in the sudden destruction of too large a number of worms within a relatively short period resulting in occlusion of the pulmonary artery or its branches, or in a toxemia from foreign protein.

Effect of Rapid Destruction of Adult Worms

Dog 556, weighing 25.5 kilograms (56 pounds), showed a heavy microfilaria count on preliminary examination. In order to determine the effect of a rapid destruction of adult worms, this animal was given on each of two consecutive days 5cc of Fouadin intravenously. The blood became negative for examinations for microfilariae two days after the last dose of the drug. There was marked depression for a few days following treatment, and the temperature rose to 105.6° F. on the 4th day. The dog gradually returned to normal and remained so until the 28th day following the beginning of the treatment, when it exhibited a deep bronchial cough. On the 30th day, the dog had several convulsions with clonic spasms of the muscles of the jaw, some of the body muscles and those of the limbs. On the evening of that day the dog was in a semi-comatose condition; it died during the night. Postmortem examination revealed a bilateral pneumonia with red hepatization.

The lungs were markedly edematous and contained nodular abscesses filled with dead *Dirofilaria*. The pulmonary artery and its branches were occluded with dead and dying worms. The heart was markedly hypertrophied, the bicuspid valve was inflamed, and there was an endocarditis in both ventricles. A total of 51 worms were recovered of which only one remained in the heart. There was marked passive congestion of the liver, kidneys, spleen and other tissues.

The experimental results obtained in this

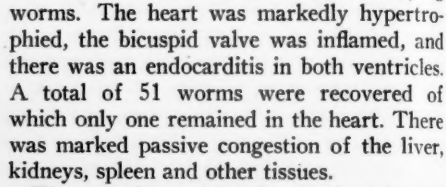


Fig. 4.—Section from lung of Dog 415 treated with Fouadin, showing cellular infiltration surrounding dead *Dirofilaria immitis*. X 117.

case adequately emphasize the hazards involved in forcing treatment for heart-worm disease by giving large doses of a drug within a short period of time. In cases where blood examination indicates the presence of a heavy heart-worm infestation, it would appear advisable to use small doses of the drug over a reasonably long period of time. If necessary, a second course of injections could be given with a view to destroying any worms remaining after the first course.

Pathology Associated with the Administration of Fouadin

Hassan and Effendi, as reported by Khalil[6], found that the antimony contained in Fouadin is cumulative in its action, and that

it is excreted only very slowly from the body. In a study of human patients over periods varying from 29 to 54 days, they determined that the maximum concentration of antimony in the system occurs immediately following the last injection. There is reason to believe that the antimony concentration in the body of the dog reaches its height at a corresponding period in the course of treatment and that this period probably represents the crisis in the treatment cycle.

The above-mentioned investigators determined that only 48.9 to 55.5% of the antimony administered was excreted in the periods mentioned above, the remainder being retained and probably given off slowly over a relatively long period of time. If the excretion in the dog is at a corresponding rate, this fact would provide an adequate explanation for the cumulative effect of the drug on adult worms, an effect not immediately operative but one which acts over a considerable period of time following the conclusion of treatment. Over the period of treatment, only 2.3 to 4.6% of the antimony was excreted through the feces while the remainder was excreted through the urine. The kidneys, therefore, apparently bear the brunt of any damage resulting from the administration of Fouadin, and these organs and the liver are the organs showing the most severe lesions as a result of the Fouadin treatment.

Sections of the liver, kidneys, and heart muscle were obtained from all dogs which died as a result of the Fouadin treatment and from all dogs killed after varying periods of time following the termination of treatment. These sections were stained with Sudan III, hematoxylin and eosin, and Masson's differential stain. A study of these sections revealed a histopathology of varying degree, depending on the total amount of Fouadin injected, the rapidity with which the injections were given, and the length of time after the last injection at which the sections were taken.

There was apparently little damage to the cardiac muscle as a result of the Fouadin treatment. In a few dogs, the muscle showed a slight cloudy swelling but this condition was not pronounced and it is questionable whether this lesion was directly associated with the treatment. This observation is in agreement with the results of pharmacological tests conducted by Hammouda and reported by Khalil[6]. Hammouda found that Fouadin in very large doses, far above those recommended for treatment in man had hardly any direct effect on the heart or blood pressure.

In general, our data indicate that a course of treatment with Fouadin in the dog results in a necrosis of liver cells with pycnosis, karyolsis and karyorrhexis of nuclei and that the necrosis is most marked in the center of the liver lobule. With the necrosis, there is marked engorgement and passive congestion of the organ, usually with extensive deposits of blood pigments. However, this damage is nearly always satisfactorily repaired, as will be explained later.

As might be expected from the facts bearing on the excretion of Fouadin, the kidney apparently bears the brunt of damage from the drug. There usually results an acute toxic nephrosis with cloudy swelling of the tubular epithelium, marked passive congestion, and some formation of hyaline casts with or without necrosis. Necrosis, when present, varies considerably in amount. In most cases, it is found only in scattered tubules and not generally distributed throughout the sections. In one or two instances, the epithelium of some glomeruli was necrotic.

The lesions noted above were found in dogs that died during the course of treatment or that were killed immediately after treatment. In those animals which were killed at periods of 38 days or longer after the termination of the treatment, the liver and kidneys had returned to normal in the great majority of cases. In dogs killed prior to this time, reparative processes were usually far advanced, indicating that the organs of these dogs also were well on the way to ultimate repair. It is noted, however, that repair in the kidneys is not so rapid as in the liver. This may be due to the presence in many dogs of chronic interstitial nephritis

or chronic diffuse nephritis, conditions which we know from our experience in examining sections from hundreds of dogs to be all too common among these animals.

Comparative Toxicity Tests

Comparative toxicity tests of Fouadin and proprietary remedy A, the chemical composition of which has not been disclosed, were carried out as follows:

Dog 507, weighing 18.4 kilograms (40.5 pounds) was given 5cc of remedy A intravenously. The dog died in 12 hours. Postmortem examination revealed an intense congestion throughout all organs, with an acute diffuse inflammation of the mucosa of the intestinal tract. Sections from the liver showed a central necrosis involving approximately 95% of each lobule. The kidneys showed an acute toxic nephrosis, with necrosis of tubular epithelium.

Dog 419, weighing 17 kilograms (37.5 pounds) was given 5cc of Fouadin intravenously daily for 6 days. The dog died following the 6th injection after having received 30cc of Fouadin. Post-mortem examination revealed a congestion of all organs, with a marked gastritis and enteritis. Sections from the liver revealed a central necrosis which involved approximately 80% of each lobule. The kidneys showed an acute toxic nephrosis. In this test, remedy A was six times more toxic, dose for dose, than was Fouadin. Naturally any general statement as to comparative toxicity must rest on a larger number of tests.

An additional toxicity test carried out with these two drugs was as follows:

Dog 512 weighing 25.9 kilograms (57 pounds) received 5cc of remedy A each day for three consecutive days; the dog died after receiving the 3rd dose, or a total of 15cc. Following two doses of the drug the dog showed marked depression; it vomited several times during the 3rd day of treatment and blood appeared in the feces. Postmortem examination revealed an extensive pulmonary congestion, and a marked congestion of the liver and kidneys. The small intestine was markedly inflamed and contained a bloody exudate. The remainder of the intestinal tract also showed an enteritis. Microscopical examination of liver and kidney sections indicated a widespread necrosis in both organs.

Dog 479, weighing 25.5 kilograms (56 pounds) was treated with 5cc of Fouadin daily for three consecutive days, and was killed at the end of that time to compare the pathology with that of dog 512. On postmortem examination, there were no macroscopic lesions except a slight inflammation of the small intestine. Microscopical examination of liver and kidney sections revealed a slight cloudy swelling and slight fatty degeneration in the liver, and a cloudy swelling of the tubular epithelium of the kidneys with some hyaline-cast formation. At no time did the dog show any reaction from the injections. Dog 512, which received remedy A, lost 7 pounds in the course of three days over which treatment was administered; dog 479, which received Fouadin, gained 0.75 pound in the course of three days over which treatment was given.

The tests on four dogs indicate that Fouadin is distinctly less toxic than remedy A, and other observations, not published here, bear out this finding.

Tests with Remedy A on Heart-Worm Infested Dogs

Dog 526, weighing 18.2 kilograms (40.0 pounds), received 2cc of remedy A intravenously, followed on the 2nd day by a dose of 3cc. Microfilariae disappeared from the peripheral circulation on the 3rd day. The dog suffered a marked reaction from the treatment. The animal was much depressed; there was some dyspnea and a marked edema of the region of the sternum and of the face. The dog was killed 31 days after the end of the treatment. Three dead *Dirofilaria* were recovered from the pulmonary artery of the left lung.

Dog 538, weighing 14.5 kilograms (32 pounds), was given 2cc of remedy A intravenously on the first day, 3cc on the 3rd day, and 3cc on the 5th day, in accordance with directions on the package. The dog lost five pounds in weight over the first seven days. Abscesses formed at the sites of in-

jection, and the animal became so weak from the treatment that it could not stand. The dog was killed 71 days after the end of the treatment; 61 live adult *Dirofilaria* and 40 dead *Dirofilaria* were recovered from the heart, pulmonary artery, and the lungs. A microscopical study of sections from the liver and kidneys indicated that both organs had suffered severe damage and that complete repair had not yet taken place. The liver showed marked cloudy swelling; the sinusoids were dilated and filled with blood and necrotic debris; and many of the nuclei showed degenerative changes. There was marked passive congestion of the kidneys and a cloudy swelling with desquamation of the tubular epithelium.

Summary and Conclusions

Experiments conducted on dogs infested with the heart worm, *Dirofilaria immitis*, indicate that Fouadin is a valuable drug in the treatment of infestations with this parasite. A suitable course of treatment with this drug results in the permanent disappearance of microfilariae from the peripheral circulation, in the sterilization of female worms, and in the eventual destruction of some or all of the adult worms in the heart and pulmonary artery.

Fouadin can be used either intramuscularly or intravenously. Intramuscular injections are without appreciable unfavorable local reaction, and the use of the drug in this manner does not result in sloughing or abscess formation such as is produced by most antimony compounds when administered in this way. Intramuscular injections are particularly applicable for use in small dogs in which the subcutaneous veins are small and difficult to inject and in large dogs when the physical condition of the animal demands more careful control of the dosage than can be obtained with intravenous injection. However, intravenous administration permits the use of a smaller total dose in most cases, and the results desired are obtained in a shorter period of time.

Tables 3 and 4 give suggested dose rates for intramuscular and intravenous administration, respectively, for dogs of different weights. These dose rates are based on the available experimental data and are designed for dogs in good physical condition and for animals not suffering from organic heart disease, or liver or kidney affections. Evidence indicates that there is a marked variation in the ability of individual dogs to tolerate a course of treatment with Fouadin. Such variation may be correlated with the presence or absence of the lesions noted above, and perhaps also with factors yet unknown to us. Fouadin is contraindicated in the presence of these conditions or, if treatment is attempted, the animal should be kept under careful observation and injections suspended temporarily or permanently if reactions ensue.

The action of Fouadin on adult worms is cumulative and is exerted over a relatively long period of time. The destruction of a considerable number of adult worms at any one time may result in embolic pneumonia or in an acute toxemia with consequent danger to the life of the patient. Consequently heavily infested animals should be treated with caution, and in such animals treatment should not be administered rapidly or in large doses or at too close intervals.

The administration of Fouadin did not result in abortion in one bitch treated during late pregnancy. However, as a general measure of safety, it would appear that treatment should be withheld from pregnant bitches until after whelping.

Adult worms killed by the drug are carried by the blood stream into the various branches of the pulmonary artery, are encapsulated in the parenchyma of the lung, and are eventually absorbed. Except in cases of heavy infestation involving the sudden destruction of large numbers of adult worms, the body defenses of the host are apparently capable of adequately caring for the foreign protein of dead worms, and the host usually shows no marked reaction from this source.

Evidence indicates that administration of moderate doses of Fouadin over a period of time results in a central necrosis of cells of the liver acini and in an acute toxic nephrosis. Approximately 50% of the antimony contained in Fouadin is excreted through

the kidneys, and these organs, therefore, bear the brunt of the toxic effect of the drug. However, in most dogs killed at periods of 38 days or longer after the termination of treatment, the damage done to the liver and kidneys has been found to be adequately repaired. The presence of chronic lesions in the kidneys of most dogs probably tends to accentuate the toxic effect of Fouadin on these organs for the reason that the remaining functional tissue is subjected to intensified injury.

Our data indicate that the liver injury caused by Fouadin may lead to guanidine retention with a lowering of the blood calcium level in dogs under treatment with the drug. Any symptoms of calcium tetany should be combated through the use of a suitable injection of calcium gluconate.

Comparative toxicity tests between Fouadin and a proprietary preparation of unknown chemical composition but said to contain a double salt of antimony indicate that the latter compound is much more toxic, dose for dose, than is Fouadin.

In conclusion it must be emphasized that treatment for heart-worm infestation in the dog calls for the exercise of good judgment on the part of the veterinarian administering the treatment. A careful physical examination should be made of every animal prior to treatment, and due weight should be given to the presence of chronic or acute disease conditions which might influence the tolerance of the animal for Fouadin or any other drug used for the treatment of heart-worm infestation. Careful attention should be paid also to the degree of infestation and the drug should be so administered as to avoid the destruction at any one time of too large a number of adult worms with a consequent danger to the life of the host. In many of these matters, experience alone can form the basis of rational procedure but until experience is gained, careful attention should be paid to the various points brought out in this paper.

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Predisposing Causes of Canine Distemper

By O. E. McKIM, Port Chester, N. Y.

A CONTROVERSIAL subject, such as distemper, is one to be approached with marked trepidation, lest much of the splendid work that has been accomplished thus far, be minimized and possibly irreparably wronged, through ill-advised adverse criticism which has no substantiating evidence in the form of protocols used in carefully controlled experiments.

It is the purpose of this address to focus the attention of those present, and the veterinary profession at large, on some of the contributory causes of canine distemper, and discuss the rôles played by such in this disease. It is possible and quite probable, that some of the "failures" encountered in vaccination against distemper, may be accounted for through a careful consideration of predisposing influences which no vaccination can successfully combat. These predisposing or contributory factors in the order of their estimated importance are:

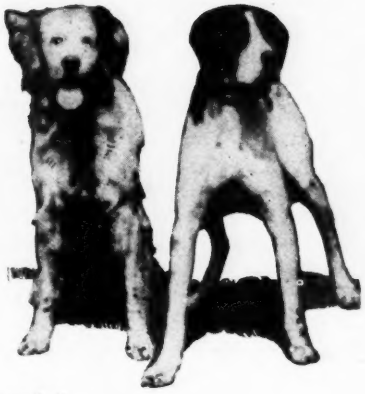
Prenatal poisoning.
Actinic deficiency.
Environmental contamination.
Deficiency diet.
Glandular disturbances.

A brief elaboration on the foregoing factors may be informative and possibly lead to further enlightenment through the medium of discussion.

Prenatal Poisoning

By this is meant a poisoning by the prospective mother during fetal life. This is encountered in puppies that have been whelped by bitches which, while pregnant, have been subjected to any one of the following conditions:

Underfed.



Overfed.
Insufficiently exercised.
Excessively exercised.
Under constant excitement.
Weakness and emaciation (illness)

It has been observed that puppies whelped with any of the aforementioned backgrounds, have been very unfavorable subjects for successful vaccination against distemper. In a paper read by the writer before this association in 1924, "Prenatal Poisoning by Tissue Extract (Cytost),"[1] attention was drawn to the effect upon the offspring by the tissue toxins of the prospective mother during pregnancy, regardless of the influence which produced these toxins. In experiments conducted on animals, both in the laboratory and outside, it was demonstrated conclusively that the aforementioned conditions were unmistakably the direct causes of weak unthrifty offspring, having a very low order of resistance.

Actinic Deficiency

This is encountered in this latitude in the puppies that are whelped between the months of August and December. It has been observed, that in this latitude, the actinic rays of the sun are below the horizon between the latter part of September and the early part of April. Those puppies that are so unfortunate as to be whelped in the late fall are compelled to start life with a tremendous handicap. They are deprived of the actinic influence so nec-

*Read before the Fiftieth Annual Meeting of the Veterinary Medical Association of New Jersey, January 4-5, 1934, Newark, N. J.

[1] Veterinary Medicine, March, 1924.

essary to calcium metabolism, and therefore begin life with rickets and anemia resulting from that disease. Although these animals apparently do well for a time, a very high percentage of them break down and succumb at either the teething or adolescent period. It has been observed that there are two periods in the course of the life of a growing puppy, during which serious constitutional changes occur. Between the age of 4½ to 7 months, when teething takes place, is the one in which a very high percentage develop distemper or other constitutional disturbances. Up to this period they are protected to a certain extent by a temporary immunity which is acquired from the mother. A permanent type of immunity takes several months to develop, and it is for this reason that immunizing injections should be given as early in life as possible. An example in the human is cited. A child, aged one year, immunized against diphtheria on September 1st will not be fully immune until January 1st. Therefore, if exposed to diphtheria in October or November, the child may contract this disease in spite of the injections of September 1st. This in no way is to be considered as a failure of the injection to protect, as the time necessary to establish immunity to the disease had not elapsed before exposure to the contagion. Puppies that escape illness during the teething period are quite certain to be stricken at some time during adolesence—between 9 and 14 months of age. It has also been observed that those of the first group respond to treatment better than those of the latter. Products which have been developed and used as a source of artificial actinic properties, have been beneficial to a certain extent. The most generous and expert administrations of these products have not been productive of entirely satisfactory results, even though palliative benefits are sometimes obtained. In this latitude the greatest resistance is found in puppies that are whelped in January, February or March, as these are fortunate in having at least six months exposure to a sun that is sufficiently high as to give off its active actinic rays.

Environmental Contamination

This is indeed a contributory cause which in a vast number of instances has not been fully considered. In a paper presented by the writer in 1923 before this association, "Tissue Extract (Cytost) and its importance as an etioligical factor in disease,"[2] attention was called to a specific contamination through a high concentration of excretory material. The fact that this contamination is specific had been well established through laboratory and other experiments. For example a cage sprayed with an emulsion of cat tissue will induce in cats various degrees of illness, from acute pneumonia and enteritis, to chronic diseases such as arthritis, nephritis, etc. The variance in the severity of the result is dependent upon the degree of concentration of tissue used, and the natural resistance or susceptibility in the exposed animal. It was found that dogs, rabbits, guinea pigs, white rats and other animals were not affected when placed in the cage so highly lethal to cats. This observation has been supported on many occasions in general practice. Instances have been reported where breeders of dogs have taken over the premises recently vacated by cat breeders who were unable to raise a kitten. The dog breeders had no difficulty in raising puppies in the presence of this non-specific contamination. We must not overlook the possibility of a "mass infection" from a high concentration of specific virus against which it is almost impossible to immunize. An example of this mass infection is often encountered in a dog that has been immunized against rabies. Under ordinary conditions with average bite wounds the protection is ample. There are cases which occasionally occur however, where the attacking rabid dog produces very extensive multiple wounds, with the result that there is implanted such a tremendously large amount of virus, that ordinary protective doses are not sufficient to neutralize or

[2] Veterinary Medicine, September, 1923.

even alleviate the infection. This same rule holds true with animals that are exposed to distemper infection through confinement in kennels where careful sanitary measures are neglected and a high concentration of virus is present. Instances have been noted where the contamination was of a sufficiently low concentration, that no acute conditions were caused, but a chronic subacute condition was prevalent, manifested by unthriftiness, lack of growth, poor coat, high degree of parasitic infestation, etc. It has been observed that the lower the resistance on the part of a host the greater the infestation by parasites. As a matter of fact there is every reason to believe that parasites are results of conditions rather than causes of them. Those who have had an opportunity of performing autopsies on great numbers of animals which have died under various conditions, have made the observation that very few parasites are found in vigorous, well nourished individuals. On the other hand those animals that have a prolonged and protracted illness prior to death are usually found to be very heavily infested with parasites. In the consideration of environmental contamination we must also include bacteria, parasites and vermin, all of which play prominent impedient roles in the struggle for life by the unfortunate puppy.

Deficiency Diets

Under this grouping there lurks a source of much disagreement and controversy. Such fallacies as "Milk causes worms" and "Meat causes fits" are still being repeated and should be vigorously combatted. The aversion to milk is encountered mostly in the breeders of large dogs and the aversion to meat is usually found in breeders of the toy varieties. In our laboratory experiments, made to determine the affect of deficiency diets upon health, it was found that those animals that were deprived of fat and protein were the most seriously affected. The dog is a carnivorous animal, primarily intended to digest food of a high protein content of animal origin. A certain amount of easily assimilated fat is also necessary and butter fat in some form such as milk, cheese or butter is highly beneficial if not absolutely necessary. The vitamines available in milk products are also indispensable. The discussion of these essential elements however, is too lengthly and involved to be more than lightly touched upon in this presentation. Suffice it to say that deficiency diets are of utmost importance in the general picture of contributory causes because of the severe effects, manifested by weakness and the resultant production of metabolites of fatigue.

Glandular Disturbances

It is quite unfortunate that there has been so little interest shown by the general practitioner in this particular field. The medical profession has made considerable progress in its attack on conditions caused by either the over activity or lethargy of ductless glands, whose secretions are so vital to normal metabolism. Some such work has been done along veterinary lines, but not enough to establish sufficiently accurate statistics through carefully controlled experiments using litter mates as controls. The full discussions of this group, as a possible or certain contributory factor, will not be attempted in this presentation.

Summary

It is well to consider carefully the possibility of canine distemper being enhanced throught the rôle played by such predisposing causes as:

Prenatal poisoning.
Actinic deficiency.
Environmental contamination.
Deficiency diets.
Glandular disturbances.

It is also well to carefully weigh the possibilities of the existence of any of the above mentioned influences, in connection with our attempts toward complete immunization against this disease.

Conclusion

It is hoped that in all cases of "failure to protect" which are encountered, the practitioner will be guarded in his judgment, in the event that he is inclined to consider the product at fault or the theory unsound. A tremendous amount of money and energy have been expended to produce the splendid results already obtained. There never has been developed a preventive measure which was infallible or any where near 100 per cent perfect. The indefinable something which may prevent the realization of a "Utopia of Preventive Medicine" may lie concealed in one of the contributory causes that have been herein presented for consideration. Let us therefore, in cases of failure, be slow to doubt or condemn the best method of protection that has yet been placed at our disposal. We should redouble our efforts by endeavoring to find the influence which is accountable for the failure, and eliminate same for the benefit of the owner and our own professional reputation. On the other hand we must not permit ourselves to become too enthusiastic with the achievements of unusually favorable results. These are very likely to be overrated if we fail to consider that between 30 per cent and 40 per cent of normal dogs are naturally immune to canine distemper and we may develop a tendency toward overconfidence which can lead to unreasonable expectations and assurances.

We must continue to strive for perfection through the constant application and use in our every day practice, of the knowledge gained through laboratory and field research. Research is the pillar, which holds high the light of knowledge.

Acetonemia in a Dairy Cow

A six year old Holstein cow was presented at the Veterinary Clinic of Kansas State College on March 2, 1934, with the following history:

At the time of calving five weeks previously it had been necessary to treat her for parturient paresis and she had made an uneventful recovery. She was a good milker producing forty to fifty pounds of milk daily without receiving any extra care. For three days previous to her presentation at the clinic it was noted that, although her appetite was good, there seemed to be a rapid loss in condition. During this three-day period a gradual loss in milk flow to less than 50% of her normal production had occurred. On March 1st, the fourth day of her illness, her condition became much worse. Early in the morning she bellowed loudly, jumped into the air, and fell on her side in a convulsion which lasted several minutes. The rest of the day she was quite nervous and wobbly on her feet, there were muscular twitchings and tremors, abnormal bellowing and anorexia was complete. It was also noticed that she was continually licking fences, ground, stones, and other objects. The peculiar actions of the cow had led the owner and his neighbors to think the cow had rabies and she was trucked to the hospital late that evening.

When examined at the clinic the cow was very thin and had a very peculiar, dull expression. At times there was a low, anxious bellowing. There was suspended rumination, slow, irregular and weak peristalsis, and a moderate degree of constipation, the feces being quite dry and covered with mucus. Respirations were eighteen per minute and somewhat of the abdominal type. The pulse rate was seventy per minute and the heart action was regular but of a strongly pounding type. The temperature was 100.5° F; conjunctival mucosa was slightly congested. These symptoms were, for the

most part, almost identical with those described by Hutyra and Marek[1] as characteristic of a typical case of acetonemia.

A rectal examination revealed no abnormalities of the abdominal organs. The udder was apparently normal except, perhaps, for a moderate distention of the mammary veins. It was not possible to determine this last mentioned symptom with any degree of certainty, since the writer had not seen this cow when she was well. However, Udall[2] mentions that Hupka observed "marked distention of the mammary veins" in cases of acetonemia.

A catheter was used to obtain a sample of urine, which was colorless, thin, and watery; urinalysis disclosed a pH of 6.0, specific gravity of 1.012, and a marked acetone content according to Rothera's test for acetone bodies.

The results of the various urinalyses made are given in tabular form.

Date	*Color*	*Odor*	*pH*	*S. G.*	*Albumen*	*Acetone*
3-2-34 A. M.	Water-white	Normal	6.0	1.012	Trace	++++
P. M.	Light amber	"	6.0	1.030	None	++++
3-3-34 A. M.	Amber	"	6.5	1.055	"	++++
3-4-34 A. M.	"	"	7.7	1.042	"	++
3-5-34 A. M.	"	"	7.9	1.037	"	Trace
3-6-34 A. M.	"	"	8.8	1.042	"	None

The test used for the determination of the acetone content of the urine was conducted in the following manner. To 5cc of a supersaturated aqueous solution of ammonium sulphate add 10cc of urine and five drops of a 1% aqueous solution of sodium nitroprusside. Superimpose upon this mixture 1cc or 2cc of stronger ammonia water. Development of a permanganate color at the line of junction is considered positive for acetone. No quantitative analyses were made nor was the milk or other body fluids tested in any manner for possible acetone content.

Diagnosis: Acetonemia.

The treatment given on the first day consisted of the following: 250cc of 50% solution of glucose intravenously and ½ grain of eserine salicylate subcutaneously. One pound of magnesium sulphate, eight ounces of sodium bicarbonate, one-half ounce each of nux vomica and powdered gentian, and two drams of tartar emetic were dissolved in four gallons of warm water and given via the stomach tube.

The following day the cow appeared somewhat brighter, the heart action and sounds were normal, and the feces were quite liquid. The appetite was poor, however, and peristalsis, while regular, was quite slow and weak. Medication on this day consisted of six ounces of sodium bicarbonate in capsules morning and evening, 250cc of 50% glucose solution intravenously, and ½ grain of eserine salicylate subcutaneously.

On March 4th the same treatment was administered as on the previous day except that the eserine salicylate was omitted, as rumination and peristalsis were normal. The appetite, feces, and respirations were normal; the milk flow was markedly increased. The following day the sodium bicarbonate and glucose solution were given again. The cow appeared normal; a glance at the table of urinalyses shows that the urine was nearly normal. March 6th the patient was dismissed from the hospital, apparently, entirely recovered. The temperature curve had remained within normal limits throughout the entire course of the disease. According to Udall,[2] Hudson says that under proper treatment recovery takes place in about three days. Hayes[3] states that the convalescing period is prolonged, extending over four to eight weeks.

[1]Hutyra, Franz, and Marek, Josef: Acetonemia in Cattle: Pathology and Therapeutics of the Diseases of Domestic Animals, Volume II, page 105.

[2]Udall, D. H.: Acetonemia in Cows: The Practice of Veterinary Medicine, page 137.

[3]Hayes, W. F.: Acetonemia of Cattle: *The North American Veterinarian*, 1931, Volume 12, Number 3, page 31.

It is perhaps worthwhile to note that at no time during the course of the disease in this particular case was the odor of acetone discernible in the milk, urine, or breath. This odor has been recorded by Hutyra and Marek[1] and Truax[4] and their observations corroborated by Hayes[3] as being quite characteristic. Truax also states that the milk was strong and bitter. The milk in this case had a normal taste. Sampson, Gonzaga, and Hayden[5] state, "we are inclined to believe that it [acetone in breath] cannot be accurately detected in those cases that are of a less severe type."

The clinical symptoms in this particular case were characteristic of acetonemia as found in the average case with the exception of the lack of the acetone odor. The treatment produced as prompt results as can be expected for this condition.

If veterinarians having cases of this disease will record their observations and the treatment used it will add materially to the fund of knowledge concerning it and aid greatly in its recognition.

B. B. Coale.

Manhattan, Kans.

The above illustration shows a calf that weighed eight pounds at birth and lived a month. I would like to know what the record is of the smallest living calf. The calf pictured here became sick when about a month old. No one here knew what was wrong, so it died. Its weight at that time was twelve and one-half pounds.—R. B. Doty, Safford, Arizona.

[4]Truax, E. R.: Acetonemia of Dairy Cows: *Fort Dodge Biochemic Review*, 1930, Volume 1, Number 1, page 5.

[5]Sampson, J., Gonzaga, A. C., and Hayden, C. E.: The Ketones of the Blood and Urine of the Cow and Ewe in Health and Disease: *The Cornell Veterinarian*, 1933, Volume 23, Number 2, page 184.

The Lang Colic Treatment

Every veterinarian has his pet method of handling colics, but in our observation the one which is most logical is known as the Lang Colic Treatment. The procedure was first described by a British Veterinarian, W. M. Lang. In 1920 W. E. Muldoon introduced it into this country where it has been tried by the veterinary corps of the army and many practitioners.

The original prescription consisted of two pounds of sodium chloride and one ounce of formalin dissolved in eight gallons of water and administered by means of a stomach tube. This prescription has been modified by E. J. Frick and used in the clinic at the Kansas State College for the past 13 years.

The modified solution consists of one pound of magnesium sulphate and one ounce of formalin dissolved in eight gallons of water, preferably warm. Sometimes one or two quarts of mineral oil is added. When advisable in certain cases this liquid can be hastened in its passage through the digestive tract by giving ⅛ to ¼ grain, repeated doses, of arecoline hydrobromide subcutaneously.

This solution is practically isotonic, that is, its salt does not extract fluids from the blood nor is the water taken up from the intestines. The large volume of water softens up the food material and aids in flooding it through the digestive tract. The formalin tends to reduce gas formation by its anti-fermentative action upon the ingesta, and the oil leaves a protective and lubricating coating on the intestinal mucous membrane. Arecoline hydrobromide, when used, stimulates peristalsis and the secretion of digestive fluids, and when the case is urgent hastens the flushing action of the liquid.

This treatment is useful in most cases of colic. It has been used for inaction of the small colon, large colon, and cecum; also for tympany of the cecum and large colon. In catarrhal cases it has a cleansing, stimulating action upon the mucous membrane.

There are many advantages for the veterinarian in the treatment outlined above. The horse is thoroughly cleaned out in a short time without the weakening effect of common purgatives. The mechanical or physical action of a large volume of water is certainly better therapeutics than the administration of a small amount of drastic cathartics, such as aloes. The appetite soon returns and the horse is ready for work in a few hours. It leaves a good impression on the client, because he sees the large volume of material used and realizes that you are trying to help the animal. Passing a stomach tube helps to differentiate many forms of colic, such as a twist, acute gastric bloat, etc. The stomach tube, as a rule, can be passed only by the veterinarian. The client does not have one and if he did he would hesitate to use it. He has more respect for ability of the veterinarian because he sees him do something that he himself cannot do. If reasonable care is taken and the animal watched while pumping this liquid in, there is little danger of injury to the horse. The practitioner very seldom has to hurry back several hours later because the patient is getting worse. The postmortem records covering a period of years show that all cases that terminated fatally under this treatment were hopeless for any treatment.

Dec. 1, 1933, a six-year-old black Percheron horse was brought to the veterinary clinic of the Kansas State College. The owner in giving the history of the case stated that for the past 24 hours the horse had not passed any feces, and in the last few hours had shown symptoms of colic. The animal was restless and wanted to lie down. The temperature, pulse and respiration were taken and found to be normal. No gas could be detected in the cecum or large colon. On rectal examination the large colon was found to be distended by a firm mass of feces.

The stomach tube was passed and the modified Lang colic treatment — one pound of magnesium sulphate and one ounce of formalin dissolved in eight gallons of warm water—was administered via the stomach tube. This was followed by an enema of warm water, which probably helped to soften some of the hard mass in the large colon. The horse was then led outside, walked around for awhile and not permitted to lie down.

The patient was then placed in a box stall for the night. Five hours later it was quieter and showed no symptoms of pain. The desired action was evidenced by the passage of a large amount of feces, which continued until the patient was thoroughly recovered. If feces had not been passed by morning the animal would have been given repeated ⅛ grain doses of arecoline hydrobromide subcutaneously. The impacted mass would have been thoroughly soaked by an enema using epidural anesthesia to allow complete relaxation of the posterior parts.

The above line of treatment is not a panacea for all forms of colic but is rational therapeutics in indicated cases and gives the best satisfaction.

W. E. Ivey.

Manhattan, Kans.

* * * *

Milk Therapy

In recent years, the use of sterile milk, intramuscularly, in veterinary practice has gained prominence as a therapeutic agent for a variety of pathological conditions of the eye. This treatment is beneficial due to the protein reaction it produces against the specific pathological processes involved.

The use of sterile milk for relief in periodic ophthalmia, ulcers of the cornea, and ulcerative keratitis is becoming common. This product is prepared by placing the desired amount of fresh milk in a sterile container and heating until it begins to boil. It is then cooled and the casein which coagulates on the surface by heating is removed with a sterile spoon or spatula.

The milk is injected into the heavily

muscled pectoral region by means of a hypodermic syringe. The site of injection is thoroughly cleaned with a suitable disinfectant before the injection is made. A second injection is not made until all evidence of inflammation resulting from the first has disappeared. If no suitable reaction results from the first injection, a larger dose may be given.

Sterile milk is given in the following dosages: dogs, 2.5 to 10cc; cattle, 10 to 25cc, and horses, 15 to 30cc.

Case No. 1234 in the clinic files of the Division of Veterinary Medicine, Kansas State College, is an excellent example of the efficacy of milk therapy. The animal, Inka, a nine-months-old Holstein bull belonging to the Dairy Husbandry Department of the college, was brought to the clinic for examination and treatment.

The following history was given by the herdsman in charge. "Animal had been hooked in the left eye during a scrimmage with another animal. The wound had been treated several times with eye ointments."

Symptoms: Ulceration of the cornea, profuse lacrymation, opacity of the lens, and congestion of the mucous membranes.

Diagnosis: Ulcerative keratitis. Fluorescin solution was used as an aid in diagnosis.

Treatment: The animal was given repeated doses of sterile milk (25cc) at fourteen-day intervals. A 1% yellow oxide ointment was applied to the injured eye.

After about six weeks the ulcerative condition completely disappeared, lacrymation ceased and the eye regained its normal function.

Elmer L. Metcalfe.

Manhattan, Kansas.

Connecticut Enteritis Powder (for Poultry)

Sodium Phenolsulphate .....4 parts
Zinc Sulphate .....4 parts
Catechu .....8 parts

S.—One teaspoonful to the gallon of drinking water and continue for one week.

Then dose with epsom salts and repeat with the enteritis formula for another week.

Effects of Different Brooding Temperatures on Pullorum Disease*

Pullorum disease is an especially important disease due to the many ways of transmission. Not only is the disease transmitted from the infected hen to the chick through the egg, but it is also spread from hen to hen and chick to chick. In the present discussion, we are interested only in the latter type of transmission.

The extent and fatality of pullorum disease in chicks are very erratic. It is not an uncommon experience for one poultryman to have a high mortality and another a low mortality from chicks hatched in the same incubator and from the same flocks. The conditions under which the chicks are brooded is believed to be the cause of this variability. A study of environmental factors to determine the part each factor plays in this variation is being made. To determine the influence of temperature of brooding a special brooder of four compartments was built. Temperatures of 72°, 80°, 88°, and 96° F. were maintained. Chicks were brooded at these temperatures, using clean stock alone and clean stock mixed with infected stock. The loss of chicks from pullorum disease in the infected and mixed batches was six or seven times as high in the chicks brooded at 72° as in those brooded at 96° F. The transmission of the disease from the infected stock to the clean stock was much higher at the unfavorable temperatures of brooding. The data demonstrate the extent to which unfavorable conditions lower the vitality of chicks and thus render the chick more susceptible to pullorum disease.

The value of a proper brooding temperature for young chicks cannot be questioned. The lack of a proper amount of heat in the brooder is much more disastrous, however, upon chicks from pullorum infected flocks than upon chicks from non-infected flocks. Environmental factors and feed are most important in the transmission of this disease.

*Notes from an address by W. L. Mallmann, East Lansing, Michigan, at the Eleventh Annual Post-Graduate Short Course for Veterinarians, Michigan State College, East Lansing, January 22-26, 1934.

This is noted in the transmission of colds and other disease as it is in pullorum disease.

* * * *

Chronic Tendonitis of Horses

Chronic conditions involving the legs and feet of horses and mules constitute some of the most perplexing problems of the general practitioner. These conditions are stubborn if they respond to treatment at all, and as the value of an animal is proportionate only with his ability to do work, these ailments, chronic or acute, are important.

October 26, a black mare mule, ten years old, was presented at the veterinary clinic of the Kansas State College for treatment. The animal was distinctly lame in the left fore leg. The flexor area between the carpal joint and the metacarpal phalangeal articulation was swollen to about three times its normal size. It appeared indurated and fibrous. The condition had persisted for a year, and though blistered repeatedly had not responded to the treatment. The diagnosis was chronic tendonitis of the superficial digital flexor.

In such conditions an operator has an option of two treatments: a series of blisters; the other, a more radical one, firing the involved tendon. The purpose of either being to change the existing chronic condition into an acute inflammation, with resulting resorption of the excess deposit. Point firing was decided upon as the method of choice in this particular case.

The animal was placed on an operating table in lateral recumbency, with the right side uppermost. The operative area from the carpus to the fetlock was clipped, shaved, cleaned, and disinfected by washing in alcohol and applying two coats of tincture of iodine.

Inasmuch as firing is a very painful operation, it is a practice at this clinic at all times to anesthetize by nerve blocking of the operative field. The median and ulnar nerves of the fore leg innervate this area and our operation can be made painless by blocking these two nerves.

Median Nerve: This nerve is best reached on the medial surface of the anterior limb, two or three inches below the elbow joint, just back of the radius. It is covered by the skin and deep fascia of this region, and overlapped by the anterior border of the flexor carpi radialis muscle. Ten cubic centimeters of a 2% procaine solution were injected in this area to effectively block all the medial surface of the limb from the point of injection downward as well as to partially anesthetize the lateral surface of the leg from the carpus downward.

Ulnar Nerve: This nerve is quite superficial, about four inches above the accessory carpal bone. It is lodged between the middle and lateral flexors of the carpus and covered only by the skin and deep fascia of this region. To block this nerve, 10cc of a 2% procaine solution was injected.

A SandS ether cautery with a blunt point was used. Firing was done by making one row of punctures, one inch apart, extending the length of the involved area. To place these punctures any closer together would increase the possibility of sloughing between the points. Each point was gone over several times until the depth of the wounds extended from three-quarters to one inch. This operation caused no distress to the patient nor any hemorrhage. A dry pack was applied to the leg. The pack was impregnated with a powder consisting of boric acid and iodoform.

Acidi borici	℥ix
Iodoformi	℥i

M. ft. Pulvis

The wounds were redressed daily and a clean pack, like the first, was applied each day for a week. The mule was sent home with instructions for the owner to keep clean bandages on the leg to prevent an infection and to allow for three weeks' complete rest.

Response to this time-honored procedure is as good now as it ever was, and though it is extremely radical and has limited indications, it undoubtedly extends the usefulness of many chronically lame animals.

L. J. Michael.

Manhattan, Kans.

Partial Amputation of the Penis in the Horse

The indications for partial amputation of the penis in the equine subject are inability to retract the organ into its sheath as in paralysis, or malignant tumors, or when there is a stenosis or stricture of the urethra.

The operation is performed with the animal in recumbency, either secured to an operating table or in the ordinary cast position. A general anesthetic may be employed, or if preferred, one may use a combination of 60cc of a 0.5% sterile solution of procaine epidurally and local infiltration of the organ to be amputated with 1% sterile solution. Where the latter is used an ounce of chloral hydrate in one gallon of water via the stomach tube will aid in keeping the patient quiet. To prepare the operative area wash it free of extraneous material with soap and water and apply tincture of iodine.

The penis is drawn out of its sheath as far as possible and a tourniquet wrapped around the organ at its entrance into the sheath. A catheter is inserted into the urethra in order to display the identity of the urethra when it is encountered later in the operation. The operation generally practiced is the so-called Vinsot's operation. A triangular opening, the arms of the triangle 1¼ to 1½ inches long and with the apex directed towards the sheath, is made directly over and down to the urethra. The next step consists in splitting the ventral wall of the urethra in the operative area both longitudinally and transversely at the distal portion of the wound. The edges of the cut surface of the urethra are then sutured, with closely-placed, interrupted sutures of chromic catgut, to the edges of the skin wound. The next procedure is to place a rubber ligature (rubber tubing) completely around the body of the penis anterior to and corresponding to the base of the triangle, or a fixation suture of umbilical tape may be used in its stead. The portion of the organ to be amputated is then divided with one sweep of the knife at least one inch anterior to the ligature.

After care consists in keeping the sheath free of wound *debris* by flushing it with a mild antiseptic solution as needed. There are two outstanding dangerous sequella of the operation, namely hemorrhage and urethral stricture. Hemorrhage unless properly controlled from the corpora cavernosa in which the blood circulates in large cavernous spaces instead of blood vessels, and in which erectile tissue tends to keep these spaces open, would soon prove fatal. Also, if the edges of the incised urethra are not sutured carefully to the edges of the skin incision, stricture of the urethra may result. However, if due care is exercised in the operation, these unfavorable incidents are appreciably avoided.

R. C. Jensen.

Manhattan, Kans.

Congenital Conjunctival Dermoid

The Dairy Department of the Kansas State College presented a five-day-old, Jersey, bull calf to the veterinary clinic to be used for food for the small animals. A tumor-like growth upon the cornea and the membrana nictitans was found. The tumor was so extensive as to cause complete blindness of that eye. The growth upon the cornea consisted of a fan-shaped extension of skin, containing hair of various lengths, which extended over the lower portion of the cornea. The tumor involving the membrana nictitans was much smaller and less extensive, but caused a protrusion and enlargement of the nictitans membrane. (See illustration.)

Cattle seem more prone to various congenital structural irregularities than any other species of animals. These congenital tumors of young animals are, according to embryologists, due to faulty development of the embryo. Embryonic cells may wander to any region of the body but are found most frequently in the region of the head. When these wandering cells become lodged, they immediately begin development. It may be said also that the nictitans membrane of all species of animals is especially susceptible to tumor formations.

Prognosis: The prognosis in these conditions depends largely upon the nature and the extent to which the surrounding structures have become involved. The less tissue involved, the more favorable is the prognosis. The prognosis is improved if the lesion be susceptible of removal without destroying too much tissue. When the condition can be remedied by complete removal of the eyeball, the prognosis is favorable as that is a comparatively simple operation, the outcome of which is usually satisfactory.

Treatment: The treatment of choice consists in cutting the growth off completely and then following this by cauterization. If the process is not sufficiently discrete that it may be dissected off, then its growth may be stopped by cauterizing with phenol. Because the eye is both delicate and sensitive and the membrane nictitans is difficult to fix, very careful operative measures must be observed at all times, to insure against any possible injury to the eye which may interfere with its function.

When removal of the neoplasm alone cannot be carried out, complete removal of the eyeball may be adopted. This operation is simple to perform and is very satisfactory as no discharging wound remains and little if any aftercare is necessary.

H. T. Mydland.

Manhattan, Kans.

The Use of Sodium Iodide in Prostatitis

Chaunchree was one time a very fast track dog, a greyhound, winning many heats in the hurdle events in fast competition and setting several records. He was trained in Europe and brought to the United States several years ago.

He was presented at the veterinary clinic of the Kansas State College, December 9, 1933, for the reason that although he had proved himself a capable sire in the past, he had become sterile and had been in this condition for eight months. The last litter he sired was then about six months of age. None of the last three bitches he had served had conceived. Chaunchree was then 10 years old.

By manipulation of the penis we were able to get a sample of the semen in a syringe and transfer it to a glass slide for microscopic examination.

Our examination revealed a large number of spermatozoa. All were active to a high degree. We were quite certain we found leucocytes, a few granules, and some endothelial cells.

We then placed some semen on a slide and washed with 0.5% chlorozene for seven minutes to dissolve the mucus and washed with tap water and 95% alcohol. We stained this slide with spermatozoa stain (alcohol one part, carbon fuchsin two parts, alcoholic eosin one part) for two minutes. Next we washed it and stained with sperm stain number two (Loeffler's methylene blue one part, distilled water one part), for three seconds. We found spermatozoa, leucocytes and granules present.

The prostate gland was palpated and found to be enlarged and sensitive. No other pathological changes were detectable, therefore the case was diagnosed as prostatitis.

In treating the dog, five grains of urotropin was given per os daily as a genitourinary antiseptic. Also 31 grains of sodium iodide, 20cc of a 10% solution, was administered intravenously.

This drug, although still in its experimental stage, has been reported as giving good results in many cases of epididymitis, prostatitis, orchitis, vesiculitis, and arthritis and nearly all conditions for which non-specific protein injections have been advocated. Sodium iodide seems, first, to stimulate all living protoplasm and, second, to promote a lysis and disintegration of all dead and dying protoplasm and all pathological exudates.

This drug was administered every other day in the same dosage until three injections had been given.

Each examination of the semen showed a decreased number of leucocytes and endothelial cells. These examinations were made every other day until the semen was almost normal.

The dog was then sent home and the owner was told he could be used for breeding immediately. He did by breeding one of his own bitches at once. She conceived and is now in advanced pregnancy.

H. F. Sibert.

Manhattan, Kans.

Worm Treatment in Chickens*

In our experience there is only one treatment for worms in chickens that is worth while from the poultryman's viewpoint and that is the iodine vermicide treatment. In addition to removing the worms iodine kills them and their eggs and that is important especially as regards tapeworms. Nicotine, for example, removes about 33% of the worms, but does not kill them and may be said merely to intensify worm culture, since the chickens eliminate the worms more rapidly and more readily reinfest themselves.

Iodine does not hurt the chickens if it is administered properly. This is not true of Kamala, which, if given in sufficient doses to remove the worms, is very harmful to the host. An effective worm remedy must be given in liquid form. The object is to get the maximum amount of the medicament to the worms in the shortest time. I have found iodine throughout the length of the intestines of chickens in three minutes after it was administered and it was probably there a good deal earlier, but it takes about three minutes to kill the chicken and autopsy it.

Iodine is defecated by birds within a short time often within 12 to 15 minutes after it is administered. On the other hand, I have found certain makes of capsules practically undamaged in the gizzard of chickens two weeks after they were administered. If the capsules are not promptly and completely broken up or dissolved, the contents will obviously leave them little by little, i. e., in too small quantities to have adequate vermicidal or vermifugal effect.

*Notes from an address by H. J. Stafseth, East Lansing, Michigan, at the Eleventh Annual Post-Graduate Short Course for Veterinarians, Michigan State College, East Lansing, January 22-26, 1934.

Intestinal Anastomosis in Swine

History.—August 2, 1933, a Duroc Jersey gilt, weighing approximately 90 pounds, was brought into the Geneva animal hospital for treatment. The owner stated that the pig had an abdominal hernia which had ruptured on the ventral surface a few days previously. He further stated, that on a few occasions, he had noticed material dropping from the opening, but did not know what it was.

Diagnosis.—The pig was placed upon the operating table in dorsal recumbency, and the operative area thoroughly cleaned and painted with tincture of iodine. Examination revealed a loop of intestine adhered to the side of the hernial sac. Strangulation of the intestine had resulted in gangrene and rupture of the intestinal wall, permitting the intestinal contents to escape. The intestinal contents accumulating in the hernial sac had caused necrosis and rupture of the belly wall, permitting the discharge of intestinal contents upon the ground. The material the owner had noticed dropping from the opening was the ingesta.

Treatment.—The hernial sac and a small area surrounding it was anesthetized by infiltration with a 2% solution of procaine. A large opening was made in the sac, and adhesions between the intestine and hernial sac were broken down by blunt dissection. The affected portion of the intestine was necrotic for a distance of approximately eight inches. This was removed as was also V-shaped piece of mesentery corresponding to the section taken from the intestine. A number ten gelatine capsule filled with boric acid and sodium bicarbonate was placed inside of the two ends of the intestine, which tended to hold them in apposition. Chromic catgut number three was used for suture material, and by means of Lembert sutures the two ends of the bowel were united. These sutures were placed very close together around the circumference of the intestine. The edges of the mesentery were then sutured together with interrupted sutures of catgut. The intestine was then returned into the abdominal

cavity. The hernial ring was closed with a continuous suture of linen thread. Three wires were passed through the hernial sac close to the abdomen. Between the wires and the abdomen a strong rubber band was fastened tightly. The purpose of this was to stimulate the formation of sufficient inflammatory tissue to give proper support, and to close the hernial ring.

Aftercare.—The owner was instructed to take the pig home and put it in a clean stall, well bedded with dampened straw. No food or water was to be given for the next twenty-four hours, and for the following few days only a light laxative feed. These directions were carried out, and the pig made an uneventful recovery; the owner stating it didn't miss a single feed after the imposed fast.

L. G. Shaw.

Manhattan, Kans.

Furunculosis of Dogs

Very few practitioners who have had to treat furunculosis have done so with satisfying permanent results. It has always been to us a source of worry and dissatisfaction. We have treated many cases according to the prescribed methods, namely, surgical removal, cauterization, antiseptic liquids and powders, stock and autogenous vaccines and curretage. For the most part, the results have been unsatisfactory, often the diseased condition recurring and necessitating confinement to the hospital for long periods.

Several months ago, we were requested by Doctor De Camp of Rare Chemicals, Inc., to use azamine on cases which, in our judgment, were difficult or non-responsive to treatment.

Many of you no doubt are familiar with azamine. To those who are not, I would suggest that you obtain Rare Chemicals' literature becase I feel that in azamine we have a powerful bactericide, unequaled in our experience, for its use against many forms of infection which have long baffled the practitioner.

In the treatment of furunculosis we have used 1cc of a 0.5% solution for each pound of body weight for subcutaneous and intravenous use.

We have obtained better results by intravenous use and injections subcutaneously in and around and under the affected areas than in the application of azamine in ointment form.

Case Reports

Case 1.—An Irish terrier brought to the hosptial with numerous affected areas on head, legs, sides and tail; owner heartbroken as she had previously lost an Irish terrier with generalized furunculosis. Patient's weight was approximately 20 pounds. 20cc of a 0.5% solution was given intravenously every other day and about 5cc injected subcutaneously in, under and around the affected parts. This treatment continued for about twenty days. Nodules were squeezed out, necrotic tissue removed; no other treatment given. The patient sometimes vomited about twenty minutes after treatment and occasionally missed a meal. The patient returned for examination at intervals. The last injection was given about six months ago, and up until the present the condition is excellent.

Case 2.—A German shepherd admitted to the hospital with generalized furunculosis. The owners had about given up hope, as numerous preparations and treatments had given no encouragement. Patient has had three intravenous injections and several subcutaneous ones, and shows marked improvement.

Case 3.—A Boston terrier admitted with furunculosis on nose and body remained in hospital fourteen days. Discharged with no signs of recurrence.

Case 4.—A Boston terrier admitted with furunculosis on neck and legs. The patient remained in hospital two days. Was given two intravenous injections, discharged. Returned for examination in excellent condition.

Case 5.—A German shepherd admitted with a generalized infection. In view of the extent of the infection, we ordinarily would have recommended destruction. In this case the patient was treated every other day, intravenously and subcutaneously. Dis-

charged twenty-nine days later very much improved.

In our clinic we have had six cases that were injected from two to three times, at from three to seven days' interval. All showed remarkable improvement. It would seem that azamine has a place of importance in the treatment of furunculosis and we feel that its extended use will show excellent results.

The work enumerated in this short resumé has been made possible through the efforts of Doctors Gates and Liner of our hospital staff and William Sims, head attendant.

Raymond J. Garbutt,
Chief Veterinarian, A. S. P. C. A.
New York City.

The Use of Colloidal Sulphur

Sulphur is one of the oldest of drugs and still occupies an important place in our Materia Medica. The Greeks termed it Therion, which means divine. Homer recorded in one of his poems, that sulphur was of great value in overcoming the skin diseases with which Hercules was affected. As far back as 1536, it is noted the Romans used sulphur in the treatment of syphilis and many other skin lesions. Sulphur in the form of a powder, lotion and ointment is probably used more than any other drug in the treatment of skin diseases at the present time. Sulphur has played an important part in human medicine, and its use in veterinary medicine is increasing every day.

Recently the Loeser Laboratory of New York City has developed a better preparation of colloidal sulphur. This ampule is made up in a 0.45% solution. The word colloidal means a substance that is dissolved to the extent of showing no visible particles in suspension, but will not pass through a diffusion membrane.

Sulphur is used externally as a stimulant and parasiticide for eczema, mange and ringworm. It is most serviceable when used as an ointment or mixture with oil. The official ointment is often used, but Unguentum Sulphuris Alkalinum N.F. is probably better, as the alkali aids in dissolving the secretions and facilitates the penetration of the sulphur. It is taken internally as a mild laxative. It is very serviceable in rectal prolapse, hemorrhoids, and for young animals.

Case No. 1.—In the veterinary clinic at Kansas State College, a six-months-old Chesapeake dog was brought in suffering from leucoma of the left eye; the opacity of the cornea being extensive. The dog was completely blind in the affected eye. The case was treated with injections of sterile milk. The milk was injected into the heavy muscles of the neck; giving 10cc at about three-day intervals for twenty days. The condition did not improve at all.

On November 7th, the dog was given 10cc of colloidal sulphur intramuscularly. The temperature was 102.2°F. at this time. It had dropped to 101.1°F. the same day. No other reaction could be observed. The dog was noticed very carefully each day and no other changes were apparent.

On November 10th, a second injection of colloidal sulphur was given. The temperature increased just as it decreased in the first injection, and in addition a considerable swelling occurred in the muscles where the injection was made. The temperature and swelling started going down on the third day. By the fifth day both had subsided; the temperature being normal. The affected eye was at least 50% clearer on November 15th than on November 7th. The dose was repeated, with the same result as in the second treatment, and the additional symptoms of sulphur on the breath.

The dog left the hospital November 20th, with the eye clearing up rapidly.

Case No. 2.—A sixteen-months-old, male Chow was being treated at the clinic for moist eczema. It seemed as if all the hair would come off his back, and the hair on the remainder of his body was dull and rough appearing. He had been treated with ultra-violet light; in addition his diet had been changed, but the response was not satisfactory.

It was decided to try the colloidal sulphur treatment. The Chow was given 10cc in the

heavy muscles of the neck and taken home the same day. A complete recovery was reported by the owner in two weeks.

Therapeutic indications for sulphur includes arthritis and other joint diseases, muscular rheumatism, inflammatory and catarrhal conditions, septicemias, acute ostomyelitis, carbuncles, boils and as a substitute for nonspecific protein therapy.

B. F. Bridges.

Manhattan Kans.

Milk For Men

What is milk?

It is a special food produced by nature to meet conditions which were brought about by increased complexity of living organisms. Evolution raised the plane of animal life so high that the egg formula, which for long ages had sufficed for the carrying on of the highest forms of life in the world, became inadequate, and the supplementary mammalian formula was developed to meet the new requirements. The young of the mammals are brought into the world in an incomplete state of development in order to favor the mother, and their further development until they become able to eat the ordinary food of their kind is accomplished by means of the special food, milk, which the mother manufactures in her body and feeds to the young.

In view of its purpose we would expect milk to contain all the elements needed for the sustenance and growth of the young animal; and so it does. It is a perfect food for the infant who gets it directly from the maternal source without change or modification. For the adult, to whose needs it is not adapted so precisely as it is to those of the infant, and who regularly gets it at some distance from the source and more or less modified, it is an almost perfect food. It contains nearly all the food substances which the adult requires and in nearly the required proportions; and its deficiencies as an adult food are easily supplemented by common food stuffs. But although it is possible for adults to live on milk chiefly with other food stuffs used supplementarily, as the nomadic Tartars do, it does not follow that the adult dietary in general may not be arranged advantageously with milk in the supplementary role. Milk as the chief adult food finds its special place in the dietary of disease.

The milk of a number of the lower animals has been used as human food. Among these animals are the cow, goat, sheep, horse, camel, ass, yak, reindeer and llama. In the United States of America the ordinary milk of commerce is cow's milk; and in the quantitative references to milk made in this paper cow's milk is understood. While the milks of all mammals resemble each other in their main features, there are differences in the relative proportions of the food principles contained.—Edward E. Cornwall, M.D., in *Medical Times*, 62:1.

Pseudocyesis in the Dog

Pseudo-pregnancy is a form of illness which is found in the female dog very much more frequently than is generally recognized. Its cause and its cure are, as yet, but vaguely understood. Sometimes it comes on after mating, but it may occur even though she has not mated. She not only looks as if she is pregnant, but she acts as if she is, and because "the blessed event" does not happen, she often steals and adopts the young of other dogs, or, if this is not possible, she may adopt, and even suckle kittens or other small animals.

Many reports of such cases have come to me, not only from places in this country but also from abroad. From France comes this: "Many female dogs evidence a restlessness, 62 or 63 days after heat, which resembles very closely the restlessness of a dog that is going to deliver. Milk comes into the teats and it is not uncommon to see female dogs go through efforts at delivery. Frequently when they perceive they have no off-spring they adopt pieces of wool or goods, bring them into their beds and hover over them in a manner as they would over their little ones. These actions are so like those of animals who had actually born little ones that very often the owners are mistaken by them though they say they don't see how the animal could have had sex-intercourse."

We call this *false pregnancy*, but, as I said. its cause, its cure, and its prevention are, as yet. but vaguely understood. Many feel we should understand it better and are asking for a scientific explanation. I am, therefore, endeavoring to make a thorough scientific study of it, and, in order to accomplish an investigation which will be really worth while, I need the help of every reader of "Veterinary Medicine" who has seen a similar condition. The only purpose of this study is that we may better scientifically understand this disorder.

If you have ever seen an animal in this condition, you can really help and have a part in making a contribution to a scientific understanding of this disorder, if you will write me a letter and describe the animal's condition as you saw it. Tell me about the size of her belly as compared with real pregnancy. State whether or not she had milk in her teats. Describe especially how she behaved. Did she act as if with young, or as though she were about to deliver? Did she adopt the young of other animals? How sure are you that she had not mated?

Other animals, such as the cow, the rabbit and even women, sometimes go through a similar experience. Write me about any cases of this *false pregnancy* you know of, for the greater number of cases of which we have detailed information, the more accurate and scientific should be our study. I am depending on your help.

(Mr.) George Davis Bivin.

Cleveland, Ohio
713 The Arcade

Twelfth International Veterinary Congress

PROFESSOR DOCTOR W. L. YAKIMOFF

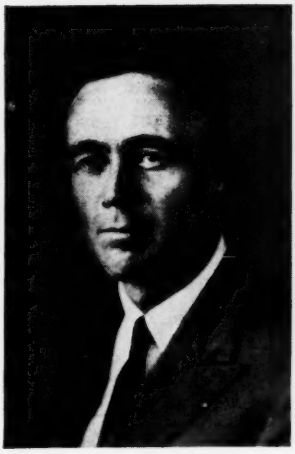
Professor Yakimoff

W. L. Yakimoff was born on January 28, 1870, in Kazan on the Volga. During six years he worked as an apothecary. Then he entered the Veterinary School in Kazan, from which he graduated in 1897. While still a student he wrote a work on "Influence of Thyroid Gland Preparations in Rabies." For this he was awarded the gold medal by the Council of the Veterinary School. Later he was graduated in medicine from the Institute of Medical Sciences in Petrograd. He began his work on protozoology, chemotherapy and tropical diseases as an assistant to Professor Dr. A. A. Wladimiroff, Director of the Epizootological Division of the Imperial Instiute for Experimental Medicine in St. Petersburg. In the beginning he paid much attention to veterinary questions, but later devoted himself to medical studies. In 1905 he worked several months with Professor A. Laveran in Paris in the Pasteur Institute. In 1909 Doctor Yakimoff went abroad for several years and studied in the following laboratories: Pharmacological Institute, University of Berlin; Division of Tropical Diseases, Veterinary School of Berlin; Zoological Station, Naples; Instituto d'Igiene Sperimentale, Rome; Pasteur Institute, Paris; Laboratory of Parasitology, Veterinary School, Toulouse; Pasteur Institute, Tunis; and in 1911 in Georg Speyerhaus, Frankfort, as assistant to Professor Dr. P. Ehrlich. He occupied this place until 1912, when the death of his wife occasioned his return to Russia. In 1913, he became director of the expedition to study tropical diseases of man and animals in Turkestan. There the Leishmaniases (Kala-Azar and Oriental sore) and many other diseases caused by protozoa in man and animals were found to be very prevalent. He studied trypansomiasis of camels and asses, the piroplasmosis of cattle, horses and wolves, besides which he studied the nuttalliosis, anaplasmosis of cattle, leucocytogregarina of dogs, trypanoplasmosis of fishes, micrifilariasis of cattle, horses, donkeys, mules, camels and frogs. As a result of his achievements on this expedition, Yakimoff was elected to honorary membership in the Society of Surgeons and Naturalists. Returning to St. Petersburg, he was made Director of Tropical Diseases and Chemotherapy. During the World War, Yakimoff was employed on the Caucasian front as Chief of the Laboratories of Zemstwo; here he had an extensive experience with protozoa of the intestine, amebiasis, flagellae, infusoria, etc. Professor Yakimoff represented then in the domain of Protozoology the Institute of Medical Sciences in Petrograd. His book on "Leishmaniasis in Turkestan" is still the most authentic work on the subject. The investigations of venereal disease of horses and Su-Auru (Trypanosomiasis of camels) are one of the most important results of the Veterinary Protozoology, likewise his explanation that the Piroplasmosis in Russia is not provoked by one single parasite, as was formerly believed but by five different parasites, viz.: Piroplasma bigeminum, Babesiella bovis, Francaiella colchica, Francaiella caucasica and Francaiella occidentalis. Yakimoff detected also a new Theileria (Theileria sergenti) in the East of Siberia and directed the control by means of immunization after Theiler, and also the use of arsenical dips against the ticks. He has collected and identified more than 30 species of Protozoa in Russia. From 1897 to 1933, Professor Yakimoff published 439 articles in Russian, German, French, English and Italian journals. He can be called the founder of the Russian Tropical Pathology. He is the member-correspondent of the Societe de Pathologie Exotique (Paris) and Societe Belge de Medecine Tropicale (Brussels), and honorary member of the Russian Veterinary Society and Soicety of Surgeons and Naturalists in Turkestan, and a member of the Microbilogical and Pritozoological Society (Leningrad). At present Professor Yakimoff is head of the Department of Parasitology in the Veterinary School in Leningrad. He will attend the 12th International Veterinary Congress in New York next August and will present a paper on "The Piroplasmoses (Classification)."

International Veterinary Congresses

The Sixth International Veterinary Congress was held in Berne, Switzerland, September 16-21, 1895. The number attending was 670. American veterinarians apparently were little interested in this Congress and none attended. No report of the meeting was published in either of the two leading veterinary journals in this country, although quite complete abstracts of the proceedings of earlier Congresses had been published.

PROFESSOR DOCTOR F. WERNER STECK



Professor Steck

F. Werner Steck was born in Berne, Switzerland, August 13, 1893, and was graduated from the Veterinary Medical College of the University of Berne; was Assistant at the Veterinary Pathological and Bacteriological Institute of Berne; Veterinary Bacteriologist and Veterinary Adviser to the Swiss Agricultural and Dairy Experimental Station at Liebefeld; studied at the Veterinary Pathological Institute of Dresden and at the Physiochemical Laboratory of Prof. Leonor Michaelis in Berlin. He was placed in charge of various departments of the Institutes for Veterinary Research of the Union of South Africa from 1922 to 1926; head of the Veterinary Physiological Department and Professor at the Transvaal University College of the University of South Africa. Since 1926 he has been Professor of Special Veterinary Pathology and Therapeutics and Director of the Veterinary Medical Clinic in Berne. Doctor Steck is an officer of the Swiss Army Veterinary Corps. His special field of research is infectious diseases.

Doctor Steck will attend the 12th International Veterinary Congress in New York next August and lead the discussion on "Infectious Mastitis," a condition to which he has devoted a great deal of study and achieved conspicuous success in handling.

The subjects discussed were: International veterinary sanitary police; the use of biologic agents in diagnosis (mallein, tuberculin, pneumo-bacilline); tuberculous meat and public hygiene; the influence of veterinary science on social development, and the improvement of public health; contagious pleuropneumonia, and the unification of anatomical nomenclature.

The Seventh International Veterinary Congress met at Baden-Baden, Germany, August 6-12, 1899; the members in attendance numbered 958. They came from all over the world, the United States having three representatives, Victor Norgaard of Washington, representing the Bureau of Animal Industry, Langdon Frothingham of Harvard University, representing the Massachusetts Veterinary Medical Association, and A. Liautard, New York, representing the American Veterinary Medical Association. The Congress had eight presidents: Nocard, Alfort; Hutyra, Budapest, Schutz, Berlin; Degivé, Brussels; Hers, Berne; Esser, Gottingen; Dammann, Hanover, and Siedamgrotzky, Dresden. It will be remembered that one of these presidents, Hutyra, has but this year retired from the presidency of the Permanent Committee of the Congress.

Among the many resolutions adopted by this Congress, the following are of particular note:

8. None other than certified veterinary surgeons can be summoned as professional men to inspect meat.

10. As a matter of principal, all inspection of meat must be founded on sure, scientific bases and experimental rules which should be agreed upon by an international understanding.

19. The extinction of bovine tuberculosis on the part of the owners is practicable and should be universally aimed at. Tuberculin should only be supplied under state control. In any case, it should be given to veterinary surgeons alone.

28. The milk of tuberculous animals is not to be used for human food, if the animals are emaciated or effected with tubercules in the mammae.

30. Infectious diseases of swine must be combatted separately by veterinary police in such a way that swine plague and rouget should be dealt with on different lines.

Heretofore, proceedings of the Congresses had been published only in French and German. Liautard pursuaded the committee having the matter in charge to publish the proceedings of this Congress in English, also, and ever since the proceedings of all Congresses have been published in all three languages. The proceedings of the 12th International Veterinary Congress, which will meet in New York in August, 1934, will be published in German, French, English and Spanish.

Abstracts

By F. VOLKMAR
Columbus, Ohio

Poacophagia in Dogs

The observation[23] that during the sultriness preceding a storm dogs will eat grass with a special delight may be explained by a certain nervosity, created by the electrical charge of the air. Other causes for eating grass are said to be: a natural thirstiness present in sultry weather, boredom, habit, hysteria, worm-infestation, foreign bodies in the stomach, a craving of the body for certain nutritive salts, dietary errors, narrow feeding ration, lack of vitamins. From the observation of the author it may be assumed, that in individual cases, the dogs will eat grass from one or the other causes mentioned above, depending upon circumstances. As a general rule, however, the grass eating is a habit of dogs acquired by convenience, probably a remnant of the feeding habit of wild dogs.

Mastitis Due to Anthrax Bacilli

A cow which had become sick, showing symptoms of moderate fever, weakness and dyspnea, was given anti-anthrax treatment on the presumption that it was anthrax,[31] since cases of anthrax had been diagnosed on a neighboring farm. The treatment consisted of intravenous injection of 100cc anti-aggressin serum on the first evening. The next morning an additional 100cc anti-aggressin serum was given intravenously and 100cc intraperitoneally; on the afternoon of the same day, further 100cc was given intraperitoneally and intramuscularly. The following day the cow was considered to be convalescent.

Four days later a diffuse mastitis developed, with anthrax bacteria present in the milk. The blood proved to be sterile, and the excrements remained anthrax-free. The mastitis disappeared, but the anthrax-bacterial content of the milk persisted, and was observed a month later.

Fatal Case of Undulant Fever

A farmer,[30] 65 years old, was ill for several months. Blood examination revealed the Gruber-Widal test to be positive for Abortus Bang in a dilution 1:400 within two hours. The complement fixation reaction was likewise positive for Abortus Bang. Aerobe cultures remained sterile, but anaerobe cultures showed gram-positive cocci in clusters. The fatal termination may be explained either through an infectious myocarditis caused by a Bang-sepsis, or an aggravation of an existing degenerative myocarditis. The source of the infection could not be ascertained.

Exostoses in the Horse

The hyperostoses, exostoses, and osteophytes of the digital bones originate mainly at the points of insertion of the ligaments and tendons.[37] They occur quite frequently and in varying degrees and forms, and have a common cause. Of special clinical importance are the so-called ringbones on the place of the insertion of the ligaments of the first phalanx. From the progressive development of the hyperostoses will develop the periarticular ringbone. This relationship could be demonstrated even macroscopically on a large number of bone specimens, especially in exostoses of the first phalanx and the periarticular ringbone of the pastern joint.

Similar conditions exist in regard to the periarticular ringbone of the fetlock joint and the coffin joint. All these bone tumors originate from the same disease process (periostitis ossificans). The collective name "ringbone" should rather be replaced by specific anatomical designations.

In addition to these chronic periostitis le-

[23]Klauke, E. 1932. Warum fressen die Hunde Gras? (Why dogs eat grass.) Deutsche Kynologen-Ztg. 14(21): 713-714. Abstr. *Tierärztl. Rundschau* 39:164.

[31]Fodak, A. 1933. Ein seltener Fall einer Milzbrandmastitis mit nachfolgender Dauerausscheidung der Anthraxbazillen bei einer Kuh. (An unusual case of anthrax-mastitis in a cow which subsequently became a persistent carrier.) Zverolek Obz. 1933:64 Abstr. *Zentralbl. f. Bakt.* I. Ref. 111.531.

[30]Sigl, A. 1933. Ein Todesfall an Bang scher Krankheit. (Death due to Bang disease.) *Deutsche Med. Wchnschr.* 1933:1093-1095.

[37]Wittmann, F. 1933. Die peri-ostalen Knochenneubildungen und Gestaltveränderungen der Zehenknochen des Pferdes. (The periostal tumors of the digital bones of horses.) *Tierärztl. Rundschau* (39) (8):123-126; (9):139-145; (10):155-159.

sions of the digital phalanges which are accompanied by exostoses and which cause changes in the contour of these bones, there are other structural changes on the first and second phalanges demonstrable (longitudinal axial torsion, lateral greenstick fractures). These structural changes depend on the position of the extremital bones resulting from the static and mechanic requirements of the digits. This causes a rearrangement of the structure of the bone tissue, which will be recognizable macroscopically. Many diseases of the digital bones (fissures, fractures, periostitis), find their explanation in this.

Of all the skeletal bones, the third phalanx shows the most variable changes of form, due to its internal structure. It occupies a special position due to its anatomical and physiological relation to the corium (specific diseases). To all this must be added the influence of the hoof upon the third phalanx.

The knowledge of the ligamentous apparatus of the digitis, and of the bone tumors occurring in this region of the places of insertion is of great importance for the diagnosis of lameness. Clinically, various forms of splint may be diagnosed on the first phalanx. Treatment of splint in advanced cases is best accomplished by individual horseshoeing.

* * * *

Obtaining Blood Samples From Birds

It is to be preferred to make the heart puncture with the chicken in erect posture.[38] An assistant grasps the animal's body over the wings, using the right hand; with the left hand the head and neck are bent backward. The feathers on the upper end of the sternum are pulled out and the skin is disinfected. Then, a bleedingneedle with the syringe attached is inserted immediately on the anterior end of the sternum, carefully avoiding injury to the esophagus or the trachea. The needle is now guardedly pushed downward, parallel with the sternal crest, until resistance is met and the heart is felt. Finally, the needle is thrust into the heart; the blood will flow freely into the barrel of the syringe, displacing the piston. Healthy chickens usually yield as much as 5cc of blood. The chicken may be bled repeatedly, allowing a certain interval of time to elapse between bleedings.

[38]Glaenz, W. 1933. Ueber die Technik der Entnahme grösserer Blutmengen von lebenden Vögeln vermittels der Herzpunktion. (Bleeding of birds by heart-puncture). *Zentralbl. f. Bakt.* etc. I. Orig. 130:462-464.

* * * *

Varying Vitamin Content of Cod Liver Oil

From the experiments[39] reported, the authors draw the conclusion that the liver oil from spawning, malnourished cod contains a somewhat smaller amount of vitamin A, but considerably more vitamin D, than does the liver oil from the well nourished, not spawning cod.

The explanation of these seemingly paradoxical findings probably is that vitamin A is necessary for the maintenance of the body also for the adult fish (as for other vertebrates), and therefore the stores are consumed when the supply of food is scarce, while the vitamin D is not consumed by the mature animal, the skeleton of which is already completely developed.

* * * *

The Cat Resistant to Echinococcus

According to experiments conducted by the author[36] upon 11 dogs and 51 cats, the post-embryonal development of the *Echinococcus granulosus* is much slower in the cat than in the dog. After the development ceases, the worm degenerates. Sexual maturity is not achieved. A large number of the artificially infected cats showed anatomical lesions. Out of 31 infected cats, 14 were able to free themselves spontaneously from the infestation.

The infestation in dogs was 100% effective. In the dog the parasite reaches sexual maturity in 36 days. Not infrequently, however, the duration of development is dependent upon individual disposition of the host-organism. Nevertheless it seems expedient

[39]Poulsson, E. and Ender, F. 1933. On the vitamin content of cod liver oil, as influenced by the nutritional state of the cod. *Skandinavisches Archiv* für *Physiologie* 66(½):92-96.

[36]Lörincz, F. 1933. Die Rolle der Katze in der Verbreitung der Echinococcosis. (The cat as carrier of echinococcus). *Zentralbl. f. Bakt.* etc., I. Orig. 129 (½): 1-11.

to treat dogs exposed to infestation, at intervals of five to six weeks as a prophylactic measure.

* * * *

The Blood Picture in Canine Distemper

It appears[44] from the investigations of Lasson that the erythrocyte count does not vary from normal in dogs affected with distemper. The number of leucocytes, however, is generally found to be increased. This condition is called a hyperleucocytosis. The lowest count was 13,400, the highest one 34,300. The proportional relationship between the different types of leucocytes is also disturbed. The neutrophile leucocytes will always more or less rise in numbers, while the lymphocytes will consequently decrease; eosinophile leucocytes are found in very mild cases only.

Unglert, too, was able to prove that the red blood picture did not change. The erythrocyte count varied in numbers within the normal latitude. Hyperleucocytosis is seen merely in a fraction of the cases. The degree of sickness cannot be determined from it. The presence of a momentous hyperleucocytosis seems to render the prognosis unfavorable. In most cases the lymphocytes are decreased, while the neutrophile leucocytes are correspondingly increased. These findings have no bearings on the prognosis. In severe forms of the disease there is, as a rule, an increase in monocytes, respectively in transitional forms. When these cells increase considerably in numbers, then the prognosis becomes unfavorable. Eosinophile leucocytes are not encountered in cases of severe illness. Their absence cannot be construed as unfavorable since these cells may be absent also in mild forms of the disease. The occurrence of basophile cells does not conform to any law.

Pirker found that the red blood cells display the picture of an anemia, while the white blood cells display that of a leucocytosis. If the disease symptoms seem to be aggravated the least bit, or if the duration of the disease is somewhat protracted, then the hemoglobin content as well as the number of erythrocytes will be found to be considerably below the average normal value. In stained dry smears, the individual erythrocyte frequently exhibits a peculiarly large central unstained portion, as an indication of oligochromasy; in a few individual cases, these cells could have been called "blood shadows," because there was practically no staining effect. In many cases polychromatic erythrocytes and erythroblasts possessing a pycnotic nucleus, could be demonstrated. They were generally scarce in numbers; occasionally, however, they abounded. The erythroblasts were normal in size. As an exception, one was encountered ten microns in diameter. Anisocytosis and poikilocytosis could not be demonstrated. The content of hemoglobin and the number of erythrocytes found, indidated an anemia of regenerative character which developed during the course of distemper, and gradually became worse.

The total number of leucocytes was, as a rule, increased. This leucocytosis may manifest itself in varying degrees. The largest count made was 47,000. In cases with favorable termination the leucocytosis persisted for a long time, gradually returning to normal. Low leucocytic counts in the presence of severe complications was an unfavorable sign, while high leucocytic counts under identical conditions, indicated a favorable prognosis. In cases of severe pneumonia, the leucocytosis persisted until death intervened. As a rule, the leucocytic index was extremely low just previous to death. (Leucocytic collapse.)

The greater part of the numerical increase of erythrocytes was primarily due to the multiplication of the polymorphonuclear neutrophile leucocytes. The latter amounted to 80 to 90% in some cases. Among the leucocytes there was a peculiar increase of juvenile forms. Occasionally, the neutrophile cells would be found to be composed of as much as 16 to 21% of band-nuclear (not segmented) juveniles, and those possessing horse-shoe shaped nuclei (Metamyelocytes). Thus, in addition to the multiplication of these cells, the juvenile types dominated the

[44] Schröder, Hans. "Die Staupe des Hundes und ihre Behandlung." (Canine Distemper and its Treatment.) Publishers: Gebr. Biscoff, Wittenberge (Germany), 1925. P.P. 49-51. Blood-findings.

cell-picture, for which Arneth had coined the term "shift to the left." Myelocytes, however, were found very rarely now and then. These symptoms proved that the virus of distemper exerts a powerful stimulus upon the function of the myelogenic-hemopoietic system. The numerical increase indicates that the bone-marrow is still capable of reaction. When the ability to react ceases, which is considered an unfavorable prognotic sign, the leucocytic index will fall (for instance when death approaches).

The absolute, as well as, the relative number of the polymorphonuclear eosinophiles was always decreased, whenever the disease assumed a severe form; but shortly before death they would occasionally reappear in small numbers. In reconvalescence, the eosinophile index would rise. Mast-cells were found very rarely. Their occurrence does not conform to any law. There existed always an absolute, and in the majority of cases, a percentage increase of monocytes (large mononuclear and transitional forms). Their count ran parallel to that of the polymorphonuclear neutrophile leucocytes. This fact is in accord with the theory of the origin of these cells from the myelogenic system. In the patients, the lymphocytes showed always a percentage decrease, but their absolute number corresponded usually to the norm, or at least, did not differ much from it. With the progress of reconvalescence, they increased in number. Once, a supernormal value was encountered at this stage (lymphocytosis of reconvalescence).

In many cases, plasma-cells were found, though they were scarce in numbers. Their plasma is strongly basophile; occasionally it contains vacuoles. As a rule, they could be demonstrated then, when erythroblasts were also present in the blood. Bloodplatelets were always found in very large numbers.

The blood-picture in distemper is not specific for this disease. Variations of the blood-picture, conforming to the different forms of distemper could not be demonstrated. Its diagnostic importance for differential purposes will not be known until the blood-pictures of other diseases have also been investigated. Unquestionably, a prognosis may be drawn on the basis of the blood-picture, in the sense, mentioned above.

Wenke observed a distinct decrease of all leucocytes in the initial stage of distemper; in the pneumonia-stage, an increase occurred, especially among the polymorphonuclear neutrophiles, occasionally also among the lymphocytes, and the transitional forms; the latter were also enlarged. When the nervous system was involved in the course of distemper, there was no shift in the blood-picture. Eosinophile leucocytes were not found in the blood of distemper dogs, excepting one German terrier which harbored numerous intestinal parasites.

Sabrazes and Muratet found neutrophile polynucleosis and hypoeosinophilia and iodophilia in the blood of distemper-dogs—(for references see original).

' ' ' '

Pregnancy Disease of Ewes

The determination of the crude fat and the moisture content of the livers of ewes with pregnancy disease[43] showed an enormous degree of fatty metamorphosis. The crude fat varied from 54% to 66%, contrasted with the average of 7.23% for the normal, control ewes. There does not appear to be a reduction in the total amount of moisture in the liver as a whole, although there is a marked decrease on a percentage basis. The glycogen content of the liver was found to be reduced to a fraction of its normal content. The sheep is thereby unable to maintain the carbohydrate level of the body and the abnormal metabolism involving the acid-base equilibrium cannot be avoided, and so appears as a characteristic feature of the disease. The extent of the loss of liver function, and of the hypoglycemia, are correlated. The function of the liver, as measured by the ability to remove rose bengal from the blood promptly, is seriously impaired. The character of the liver injury which develops is such that significant deviations were not encountered in the cholesterol and amino-acid content of the blood.

[43] Roderick, L. M., Harshfield, G. S., and Merchant, W. R. 1933. Further observations on the functional pathology of pregnancy disease of ewes. *The Cornell Veterinarian* 23(4):348-352.

Development of Veterinary Medicine in North America

By D. M. CAMPBELL

II—THE FIRST PERIOD—1790 to 1850

History lies at the root of all science.—Carlyle.

2. THE FOUNDATION

(*Continued from last month*)

Clark believed in bleeding "to effect" when he did bleed. Of this he says:

Although I am thus sparing of taking blood from horses on trifling occasions, when they may be said to be in health, yet, when cases occur do require it, I would recommend the taking away a greater quantity at once than is generally done, that is, from six to eight pounds according to the urgency of the symptoms.

A good description is given of the heart, the arteries and the veins and stress laid upon the character of the pulse as a guide when to bleed and how much blood to withdraw. In fact, a better description of the normal pulse and the abnormal pulse met with in all manner of ailments in the horse cannot be given. This would indicate that Clark must have had a very large experience over a long period of years and had been a close observer.

He is, I think, the first veterinary writer to stress the character of the pulse as an indication of the circulation and the general condition of the animal. He advises against bleeding "in all cases of extreme lowness of the body, or weakness, through fatigue, or exhaustion, and after all evacuation by purging or scouring, diabetes, or profuse sweating or loss of blood from great wounds.

There is a chapter on rowels and another on setons. Roweling and setoning was in no sense the same in Clark's view of the matter. He describes roweling as follows:

Rowels, for horses, answer the same purpose as issues in the human body; the method of introducing them is by making an incision through the skin, about three-eighths of an inch long, and then separating the skin from the flesh with the finger, or with a blunt horn, all around the orifice, as far as the finger will easily reach, then introducing a piece of leather, very thin, shaped round, about the size of a crown piece, having a large round hole in the middle of it; previus to introducing the leather, it should be covered with lint or tow, and dipped in some digestive ointment; a pledget of tow, dipped in the same ointment, should likewise be put in the orifice, in order to keep out the cold air; the parts around it soon swell, which is followed with a plentiful discharge, from the orifice, of yellowish serum or lymph; and, in two or three days at most, the discharge turns into thick gross white matter; the rowel is then said to suppurate. . . .

But, though rowels are found very beneficial in some cases, yet like a number of other operations common to horses, they sometimes, by the improper use of them, become hurtful to the constitution, and in some diseases, they frequently, instead of suppurating, turn gangrenous; hence, the cure proves worse than the disease they were intended to remove; thus, in violent fevers, where they are frequently very injudiciously applied, they never suppurate properly.

A considerable description is given of cases which are benefited by roweling, and conditions are numerated in which they should not be used. That rowels did not always produce the desired flow of pus, is indicated in the above.

Concerning setons, he says:

Setons are of great use in carrying off matter from deep seated tumors, or abscesses in different parts of the body; they ought at all times to be used in preference to making deep incisions into the muscular parts, which not only disfigure horses, but such deep incisions are very difficult to heal up in them, on account of the situation of some of those tumors, and the horizontal position of the body, which is unfavourable in many cases for procuring a depending opening, in order to carry off the matter, as in tumors on the back, withers, and the upper part of the neck, immediately behind the ears, which are very common. Besides, the horizontal position of the body, the natural restlessness and impatience of horses, renders it impracticable to fix proper bandages on these elevated parts; the situation of them likewise will not admit of proper dressings being fixed on them with any degree of certainty of their remaining for any length of time; by which means, the openings made into such tumors or abscesses are frequently left bare, and exposed to the cold air, &c., hence, such openings degenerate into very foul ulcers, and produce a great deal of proud flesh, which requires to be repeatedly cut away with the knife, as the

strongest caustics that can be applied are not sufficient to keep it under.

By "tumor" in the foregoing he means circumscribed swellings, not new growths. He is discussing, in main of course, fistula of the withers and poll-evil. To continue:

The common method of treating those large tumors, which are seated on the upper part of the neck, immediately behind the ears, generally known by the name of the poll-evil, and those which are seated on the withers, or upper parts of the shoulders, is exceedingly improper; they are either allowed to break of themselves, or are opened the whole length of the tumor on the upper part; in this situation, especially in the poll-evil, when the head is always kept in an erect position, the matter contained in the tumor cannot be discharged from it, but is retained in the bottom of the wound, and exposed to the external air, &c. it soon acquires a most ichorous corroding quality, and produces one of the largest and the most sordid fistulous ulcers that horses are infected with; a great quantity of fungus, or proud flesh, is soon produced; this requires to be repeatedly extirpated with the knife, the loss of which cannot be again supplied; hence the horse is greatly disfigured, the cure becomes both tedious and uncertain, and is seldom radical. In some cases, I have known the vertebrae of the neck affected by the sharpness of the confined matter, forming lodgments there, and after great trouble and expense, the horses were put to death.

He mentions cases in his own practice that by the use of setons were entirely healed up in a few weeks without leaving any scar or blemishment other than: "A little baldness about the lower orifice occasioned by the sharpness of the matter which likewise soon disappeared and not the least trace of a disorder remained." His success in the treatment of poll-evil appears to have been equally striking. His description of the operations of others shows the "radical operation" for fistula of the withers is by no means new, and that it was attended with pretty much the same result in the 18th century that we have seen in the twentieth.

There is a chapter on purging in which the author shows an excellent understanding of the anatomy of the digestive organs and the physiology of digestion. Of the action of purgatives, he says:

Since, therefore, purging is occasioned by giving such medicines as are found, by their irritating quality, to stimulate the coats of the stomach and guts, and, at the same time, quicken the peristaltic motions of the latter, so as to cause them to shake or throw off their contents by stool; it would appear, that the different kinds of purging medicines differ only in degrees of strength, and that they operate no otherwise upon the different humours of the body than as they stimulate the first passages more or less, and hence cause a greater or lesser evacuation by stool. So that, by this operation, we only lessen the quantity of the fluids, and clear or scour the first passages from any offending matters that may be lodged there. From hence it may likewise be inferred that there is no such thing as elective purgation, that is, by giving certain medicines, we drain off this or that particular humour from the body. This may be farther illustrated in the following case or example; when a horse, who has swelled legs, or greasy heels, gets purging medicines, they do not act immediately on the fluids contained in the legs, by carrying them off only, they act by revulsion, that is, by drawing away the fluids, &c. from the stomach and intestines; those that are in the legs are, at the same time, absorbed or drawn away from the extremities by the absorbent vessels, to supply the want in the former; and hence the swellings in the legs, &c. subside.

Commenting on the practices of the day, he says:

Many people are but too fond of giving purging medicines, and frequently prescribe them without considering whether the case may require them or not.

By "people" in the foregoing, Clark refers to veterinary practitioners.

On nearly every page of the book there is evidence that Clark intended it for the practitioners and not for horse owners. He does not use the words "veterinarian" or "veterinary surgeon" but, instead, uses "farrier" or "practitioner." He dwells at length upon conditions in which purgatives should not be used, ending with:

It must be acknowledged there is a difficulty in combating a practice which too generally prevails, although there are a number of facts which will serve to demonstrate, that the purging of horses indiscriminately is not necessary in order to prepare them for these active exercises.

Among these "facts" he cites the following:

I shall close this head with a case that happened here some years ago; two military gentlemen betted their horses to run against one another on Leith sands, for a considerable sum, and which was to take place three weeks after the bet; the horses to be rode by their grooms. Captain R's was a poney about 13½ hands; Captain M's was a gelding about 15 hands high; both their grooms were bred at Newmarket, and were keen advocates for bleeding and purging, (notwithstanding both the horses had been kept on dry food and in the best order, and the short interval of time for such treatment) in order to prepare them for running. Captain M's

horse was blooded once, and purged twice; Captain R's was blooded once, and purged once; they were both sweated in the stable with a great load of cloaths; at the same time, their stables, though separate, were kept uncommonly hot and close shut up, night and day, in the midst of summer. From this treatment, they soon lost their appetite for food, and, in about eight or ten days, they were hardly able to undergo their exercise on the sands, their strength was so much exhausted by the treatment they had undergone, the constant and violent sweating in the stable, which, of all evacuations, when continued, weakens a horse the most. In this situation, Captain R gave up his bet as lost, together with his poney, for which he had a great value; luckily for him, however, his groom, who was rather inclined to be corpulent, had put himself under a course of physic, &c. in order to reduce his weight; the poney was then put under my care, with another groom to attend him; his cloathing was immediately reduced to a single rugg, the stable-windows were thrown open in order to admit fresh air, the poney recovered his appetite for food, together with strength, spirits and activity; whilst his antagonist continued under the manner of treatment above mentioned. And, although bets were considerably against the poney at starting, yet he won with great ease, and which Captain R frankly acknowledged was entirely owing to the difference of treatment they had been under.

There is a chapter on drenches, with a good description of the proper method of giving them, and the advice that they should always be sweetened with honey or molasses to induce the animal to swallow them more readily. He speaks of drenches having occasioned "most violent coughing, trembling, panting insomuch that the poor animals were like to drop down and in some cases did die within a few hours," but apparently did not recognize that the drench had been poured into the lungs. These cases were observed, of course, in the practice of other farriers. If Clark gave his drenches by the method described, there was no likelihood of their "going the wrong way."

He points out the futility of the common practice of giving medicines to prevent diseases, as follows:

> If a man or a horse is in a state of health, what more is required, or how can they be made better; health is the most proper state of an animal body, and it is not in the power of medicine either to make it better, or to preserve it in the same state.

The theory of immunity was to await a century.

Clark speaks of the use of common salt as if it were not the custom in his time to supply it as a part of the regular ration.

The chapter on lameness is about what would be expected from a writer of so large experience and acute powers of observation. He discusses the common but erroneous diagnosis of shoulder-slip, reviewing the anatomy of the joint, and concludes: "Therefore the term shoulder-slip is improper, and only tends to mislead the young and unexperienced."

He tells us that: "Lameness frequently proceeds from tumors growing upon the bones of the legs, or on those immediately connected with them; these are commonly termed in horses splents, spavins, osslets, ringbones, &c." He states that they may occur on bones in any part of the body and describes one that he found on autopsy: "The size of a large nut on the thinnest and most transparent part of the shoulder bone (scapula) on its inside, which is placed next to the ribs," resulting in undiagnosed lameness for several years.

It will be recalled that osetomalacia was not described in England until 1860, but here, 70 years earlier, we find a practitioner thoroughly familiar with the early manifestations of that disease.

Of string halt (click spavin), he says:

> This complaint seems to be a particular affection of the nerves of the legs, which causes this kind of involuntary motion, for which no certain method of cure has as yet been discovered.

Not in nearly a century and a half have we learned more of this ailment.

It appears to have been rather a common custom to trim out the fine hair inside the ears of riding and driving horses. He states that this is a very bad practice that permits cold air, rain, dust, flies, etc., to annoy the internal ear and sometimes results in deafness. Moreover that it makes horses restless, causes them to shake their heads, sometimes turn round and even run away when driven against a cold wind or driving rain. He also deplores the practice of cropping ears and states it has much the same effect as trimming them.

(*Continued next month*)